UNIVERSITY OF MAINE
LIBRARIES

RAYMOND H. FOGLER LIBRARY
ORONO

CLINICAL SYMPTOMATOLOGY

CLINICAL SYMPTOMATOLOGY

WITH SPECIAL REFERENCE TO LIFE-THREATENING SYMPTOMS AND THEIR TREATMENT

BY

ALOIS PICK
PROFESSOR OF MEDICINE, UNIVERSITY OF VIENNA

AND

ADOLPH HECHT
PEDIATRICIAN, ST. ANNE'S HOSPITAL, VIENNA

AN AUTHORIZED TRANSLATION
UNDER THE EDITORIAL SUPERVISION OF

KARL KONRAD KOESSLER, M.D. (*Univ. of Vienna*)
INSTRUCTOR OF CLINICAL MEDICINE, RUSH MEDICAL COLLEGE
IN AFFILIATION WITH THE UNIVERSITY OF CHICAGO

NEW YORK AND LONDON
D. APPLETON AND COMPANY
1911

COPYRIGHT, 1911, BY
D. APPLETON AND COMPANY

PRINTED AT THE APPLETON PRESS
NEW YORK, U. S. A.

TO

JESSIE M. HORTON KOESSLER

THIS VOLUME IS DEDICATED

IN GRATEFUL DEVOTION

PREFACE

Clinical instruction aims to banish a set symptomatic therapy from the mind of the student of medicine. It is emphasized again and again, that therapeutic measures should not be directed against single symptoms, but whenever possible, against the primary disease.

Unfortunately, the number of morbid processes, in which there exists an effective specific therapy, is very small. The physician is obliged to select those symptoms from the total picture, which if successfully combated, will render the greatest benefit to the patient. When it is beyond our power to influence the etiologic factors, the recognition and treatment of the life-threatening symptoms become the most important task. These sometimes develop insidiously, imperceptibly, until they have climbed to such a height that an effectual intervention can no longer be hoped for.

"That side of the disease which evolves and involves danger is not always, nor in each stage, clearly and unambiguously expressed. It is frequently latent, often obscured by an apparent state of well being, and may approach so gradually and imperceptibly, that in the majority of cases, it is not suspected by the patient, and a thousand times overlooked or recognized too late by the physician."

In the succeeding pages we have expanded somewhat the meaning of "danger." To us danger is not only everything that threatens life immediately, but every symptom which indicates persistent damage, and a difficultly reparable condition.

The arrangement of material has necessitated that the discussion of the same symptom has had to be repeated at different places. It was thought preferable to consider the convenience of the reader by not referring him from one chapter to another in a book intended chiefly for practical purposes.

CONTENTS

CHAPTER PAGE

I.—GENERAL SYMPTOMS 1
A. Anomalies of the skin 1
B. Anomalies of nutrition and development 6
I. Cachexia 6
II. Emaciation 8
III. Forced alimentation 10
IV. Obesity 19
V. Anomalies of development caused in part by diseases of the thyroid gland 31
VI. Metabolism in children 34
VII. Disturbances in nutrition and development in infancy 38
Dyspeptic disorders 38
Premature and debilitated children 45
Standard values 48
C. Anomalies of temperature 53
Historical development of the conception of fever. . . 53
Causes of fever. 54
Experimental research on the nervous heat centers. . 56
Symptomatology of fever 57
General prognosis and indications for treatment in febrile diseases. 60
Therapy of fever 63
Treatment of fever in diseases 77

II.—DISTURBANCES OF THE HEART ACTION 85
Causes of cardiac weakness. 86
I. Injured mechanism of the heart action. 86
II. Disturbances in the blood supply 89
The pulse under normal and pathological conditions 90
Examination of the heart itself 100
Peripheral symptoms 111
Symptomatology of the heart weakness 117
Treatment of cardiac diseases in general 121
I. Compensated heart lesions 121
II. Compensatory diseases 126
III. Congenital heart lesions 140
IV. Diseases of the cardiac muscle 140
V. Diseases of the pericardium 146
VI. Palpitation of the heart 148
VII. Paroxysmal tachycardia 149

CHAPTER PAGE

Arteriosclerosis 150
Aortic aneurysm 152
The heart in respiratory diseases 156
The heart in abdominal affections 163
The heart in kidney affections 166
The heart in infectious diseases 167
Constitutional diseases 177
Central nervous system 181
Hyperthyroidism 186
Functional disorders 188
Intoxications 189

III.—DISTURBANCES OF RESPIRATION; DYSPNEA, AND ASPHYXIA 190
I. General part 190
II. Special pathology and therapy of dyspnea 194

IV.—PAIN IN THE CHEST 233
General remarks 233
Constrained position 233
Prognosis of chest pain. 234
Classification of chest pain 234
1. Heart and pericardium 235
2. Intrathoracic vessels 242
3. Syncopal chest pain 243
3. Syncopal chest pain 243
4. The pleura and lungs. 244
5. The mediastinum 246
6. The bronchi and the trachea 247
7. Esophagus 250
8. Intrathoracic nerves 250
9. Bones, periosteum and joints 251
10. Musculature 252
11. Nerves of the thoracic walls 254
12. The mammary glands 255
13. The skin 255

V.—COUGH 257
Purpose and origin of the reflex 257
Region exciting cough 257
Pathological disturbances of the reflex and its dangers 258
Dangers of the paroxysm of cough 258
Kinds of cough 259
When should cough be combated 261
Special indications for treatment of cough 261

VI.—THE SPUTUM 269
Absence of expectoration. 269

CHAPTER PAGE

Collection of sputum in young children 269
Gross macroscopical examination of the sputum 269
Close inspection of the sputum 271
Microscopic examination of sputum 272
Chemical examination 273
Therapeutic indications resulting from sputum examination. . 273

VII.—VOMITING 277
General remarks 277
I. Reflex vomiting 278
II. Central vomiting. 296

VIII.—DISTURBANCES OF INGESTION 303
A. Hindrance in taking food into the mouth 303
B. Hindered mastication 305
C. Difficulty in swallowing 314

IX.—EXAMINATION OF THE STOMACH CONTENTS 344

X.—DISEASES OF THE INTESTINES 358
A. Diarrhea 358
General treatment of diarrhea 363
B. Constipation and obstruction 368
C. Narrowing and obstruction of the intestines 387
D. Jaundice 402

XI.—EXAMINATION OF THE ABDOMEN. 431
A. Abdominal pain 431
General remarks 431
Stomach 432
Intestinal colic 437
Pain in the liver 446
Pain in the spleen 450
Pain in the kidney 451
Diseases of the peritoneum 454
Diseases of the female genital organs 455
Gastric crises 455
B. Tenesmus and pain in the rectum 456
General remarks 456
Proctitis 456
Periproctitis 457
Other diseases of the intestines leading to tenesmus. . 458
Diseases of the neighboring organs 461
C. Meteorism 463
General remarks 463
Etiology 464
Occurrence and significance of meteorism 465

CHAPTER PAGE

Treatment of meteorism 466
Meteorism in infants 467

XII.—EXAMINATION OF FECES 469
General remarks 469
Examination 473
A. Macroscopical examination 473
B. Microscopical examination 474
Reaction of the stools 480
General therapeutic views 481
Bacteriology of the feces 487

XIII.—HEMORRHAGE 490
General remarks 490
Course of hemorrhage 493
General treatment of hemorrhage 494
Varieties of hemorrhage 498

XIV.—EXAMINATION OF THE BLOOD 535
Introduction 535
The red blood corpuscles under normal and pathological conditions 535
General treatment of blood disease 542
Leukocytosis 544
Hemolysis 549
Cryoscopy 550

XV.—DROPSY 551

XVI.—EXAMINATION OF THE URINE 572
A. Amount and specific gravity of the urine 572
B. Albuminuria 572
C. Examination of the sediment 583
D. Glycosuria 586
E. Acetone and aceto-acetic acids in the urine 589
F. Ammonia in the urine 596
G. Aromatic substances in the urine 599
H. Leucin and tyrosin 606
I. The diazo-reaction 606
J. Uric acid 607
K. Urinary pigments 610

XVII.—SEVERE GENERAL INFECTIONS 613
Definition 613
Incubation 613
Action of bacteria in the organism, during the course of infection 641

CHAPTER PAGE

Course of infection 615
Local effect of the germs of infection 616
General symptoms in infectious diseases 617
Mixed and secondary infection 619
General treatment of infectious diseases 621
Specific treatment 622

XVIII.—AUTOINTOXICATION 642

XIX.—SYMPTOMS OF NERVOUS IRRITATION AND PARALYSIS 648
Nervous irritation 648
Paralyses 659

XX.—HEADACHE 669
Headache sometimes a symptom of grave significance 669
Different painful affections of the head called headache. . . . 669
"True" headache and its theoretical explanation 669
Kinds of headache 670

XXI.—LOSS OF CONSCIOUSNESS (INCLUDING INTOXICATIONS) 690
Varieties 690
Intoxication and autointoxication as causes of loss of consciousness 713
General remarks 713
General symptomatology 714
Prognosis 715
General treatment 715
Special part 717

XXII.—SLEEPLESSNESS 736

XXIII.—VERTIGO AND NYSTAGMUS 740
Vertigo 740
Special pathology of vertigo 743
General treatment of vertigo 752
Nystagmus 752

XXIV.—DISORDERS OF THE BLADDER (DISTURBANCES IN MICTURITION) 755

INDEX 775

CLINICAL SYMPTOMATOLOGY

CHAPTER I

GENERAL SYMPTOMS

A. ANOMALIES OF THE SKIN

The skin may show various changes which justify us in concluding that life-threatening diseases exist in the internal organs. We must, therefore, take these symptoms into consideration first, since they present themselves at once on inspection of the patient.

Paleness of the Skin.—Of special importance is paleness of the skin. One meets with it in different diseases of the blood, in diseases of the digestive organs, in constitutional disorders leading to exhaustion, and finally in affections of the vasomotor nervous system. It is, therefore, impossible to make a general statement concerning the significance of paleness of the skin as an ominous symptom. On inspection of the color of the face alone the experienced observer may suspect the presence of a serious affection of the blood (as leukemia, pernicious anemia, a severe chlorosis). The final diagnosis, however, will be possible only after thorough examination of the blood. A high degree of pallor, developing suddenly, warrants the suspicion of grave internal hemorrhage, especially in those affections which predispose to bleeding (as ulcer of the stomach, extrauterine pregnancy, typhoid fever, etc.).

Nevertheless, the inspection of the skin does not furnish a safe guide in forming an opinion about the blood picture. There are persons who show a pronounced paleness of the face without being in the least anemic or chlorotic. On the other hand, we may find chlorotic individuals striking in their blooming color. The first case may be explained by the fact that in these patients a great part of the blood is collected in the big blood reservoirs of the abdominal cavity. Vascular spasms in the face may cause paleness even when the quality and quantity of the blood are normal, whereas persons of deficient quality of blood may show a ruddy appearance, especially those who, through

chronic abuse of alcohol or constant living in fresh air, have acquired an atony of the vessel walls. Furthermore, the quality of the integument itself plays a part, in one case the cutaneous vessels being more visible than in the other, so that a pallor of the general integument may coexist with entirely normally filled vessels.

Sudden pallor is observed in psychical irritation, in states of anxiety, in collapse in the course of a myocarditis when the power of the heart diminishes suddenly. Especially in postdiphtheric patients sudden pallor points to the development of imminent weakness of the heart and often announces the immediate approach of death.

Finally, we must remember that patients suffering from Bright's disease show a particular paleness of the skin. The cause lies partly in the watery condition of the blood, partly also in the edematous infiltration of the skin, which prevents, in a way purely mechanical, the vascular reticulum from being seen through the skin.

Redness of the Face.—The question as to whether *plethora vera*, causing abnormal redness of the face, exists as a real entity is here waived. Redness of the face, especially of the cheeks, is noteworthy in individuals of delicate skin with a tendency to congestions. During high fever, too, the skin of the face is constantly reddened and at the same time turgid, but not until the temperature has reached its maximum. On the contrary, during the rise of temperature, especially in the initial chill, the skin is remarkably pale, resulting generally in goose flesh, known even to the laity. A sharply *well*-circumscribed redness of the cheeks constitutes the hectic flush of consumptives. In tuberculosis of the lungs, as well as in other affections developing within the thorax or on the neck, a unilateral reddening of the face may take place, caused by involvement of the cervical sympathetic. At the same time one observes still other symptoms caused by this nerve, such as unilateral disturbance of the sweat secretion and inequalities of the pupils. Erethistic persons may manifest a diffuse erythema of the face as well as of the skin of the trunk and of the extremities during the excitement of a medical examination; indeed in this way erroneous diagnoses of scarlet fever have been made. Repeated inspection of the skin at the time when the patient is again quiet guards against such errors. Some people suffering from scrofula especially show this tendency to erythema fugax while others do not, so that an irritable and a torpid constitution in scrofula have been distinguished. This tendency to erythema after contact or upon slight mechanical irritation is seen in tubercular meningitis. It is, like the well-known spots of Trousseau, caused by paresis of the vasomotors.

We must also remember the redness of the face in certain intoxications, in the initial stage of drunkeness and of narcosis, in poisoning

with carbon monoxide (coal gas), atropin (belladonna), opium, amyl nitrite, etc.

Cyanosis.—General cyanosis will be treated thoroughly in the chapter on Circulatory Disturbances. Here will be mentioned only the local cyanosis, which is produced by the local effect of cold and which is found in functional nervous disorders (blue edema of the hysterical) as well as in paralysis of the involved limbs. A difference between cerebral, spinal, and peripheral paralyses is not observed. Still a striking cyanosis and coldness of the paralyzed extremities are often peculiar to the spinal paralysis of children.

Other Skin Discolorations.—Other discolorations of the skin in many cases point to dangerous disorders. Thus, jaundice and subicteric discoloration, to which a special chapter is dedicated. Other important color changes of the integument are caused by chronic metal poisoning. Especially in earlier times when silver preparations were given over a long period of time for nervous affections the picture of argyria was not at all rare, and the pigmentation through continuous use of arsenic (arsenical melanosis) is observed not only if given as a medicament, but also in the habitual arsenic eaters of the Alps.

A bronzed skin is found, sometimes, in cirrhosis of the liver, especially with a simultaneously occurring diabetes mellitus (bronze diabetes); further in Addison's disease. The skin in many cases of severe phthisis is of a brownish sallow color, which, however, should not mislead us into presupposing an involvement of the adrenals. It closely resembles the cachectic color of carcinomatous patients.

We may still mention a peculiar skin discoloration prognostically very unfavorable, which, as Czerny emphasizes, may occasionally be observed in infancy. Infants suffering from severe gastrointestinal disorders at times show a dark undertone of the skin, especially on the forehead, as if a black layer were placed under the skin.

Hyperemia Test of Moszkowicz.—In connection with the semiology of the skin a new method of investigation deserves mention, which may, perhaps, in the future, enable us to localize the exact extent of those circulatory troubles which lie at the root of arteriosclerotic gangrene and the intermittent claudication of Charcot. Moszkowicz makes the member in question, generally the inferior extremity, anemic by means of Esmarch's bandage for five minutes, and after its removal he observes carefully the progressive spreading of the hyperemia. Under normal circumstances it reaches the tips of the toes in a few seconds, but in arteriosclerosis of the leg the blood returns slowly, requiring several minutes; in some cases with a high degree of narrowing or in cases of obdurated capillaries, the blood spreads to a certain mark and stops there.

Moszkowicz hopes that this method will indicate the line of amputation in these cases of gangrene, for the opinions on this question are at present very different, some surgeons amputating high up on the thigh, others finding it better to wait for the line of demarcation.

Dry and Moist Skin.—In regard to the degree of moisture which the skin possesses there exist remarkable deviations from the normal, which point to severe changes in the internal organs; yet we must remember that there are a great many diseases of the skin, which may interfere with the significance of these symptoms.

The skin of fever patients is generally abnormally dry if they are not in the stage of defervescence. Certain infectious diseases are distinguished by the tendency to sweating: before all, the so-called rheumatic diseases, as polyarthritis, polymyositis, and polyneuritis. One often finds profuse sweating in septic processes. In patients suffering from pneumonia an outbreak of sweat is generally favorable as it ushers in the crisis. We must, however, watch the general condition of the patient and observe accurately his pulse, in order not to mistake a collapse for the crisis.

In malaria the outbreak of a copious warm sweat announces the end of the attack of fever and in typhoid fever the amphibolic state is not seldom introduced by sweating. In this disease sweating is of special importance and always deserves particular attention, since it is rare in the second week and may announce deficiency in heart power caused by a perforation into the peritoneal cavity or by intestinal hemorrhage. If hydropathic measures have been applied during an acute febrile disease, it is advisable to suspend them on an outbreak of sweating, because a collapse may appear, as Buxbaum emphasizes, in cases where the sweating did not at first have this significance.

Night-sweats.—The much dreaded hectic sweats of phthisis, which occur especially in the early morning, usually signify a defervescence of the fever. At times one finds these outbreaks of sweat even in beginning afebrile infiltrations of the apex, and it often happens that this is the only complaint with which the patient comes to the physician. It is not easy to explain this ailment; possibly in such cases we have to deal with a pure toxic effect of the tubercle bacilli. In the advance stage of tuberculosis, in which mixed infections rule the picture, it signifies a septic sweat.

Against night-sweats a great number of therapeutic measures has been advocated. At first one may try the simplest means: the bedroom should be cool, and the window open at night; often light covering suffices; further, one may try partial baths, alcohol rubs, salicylic dusting powders, the taking of milk with cognac, or valerian tea before going to bed. Stronger means may be applied only when these do not succeed.

Rp.	Atropin sulphuric	.01	or Agaricin	.01 pro. die
	Bol. alb.,		Acidi camphorici	1.0 pro. die
	Aq. destil.	q. s.		
	Ut fia. pilul.	N. 40		
	Ds. 2 pills each evening.			(Penzoldt.)

Sometimes sulphonal has an antihydrotic effect; it is especially desirable in cases of insomnia (Penzoldt).

Abnormally Dry Skin.—Abnormal dryness of the skin is found in afebrile processes, accompanied by polyuria, as in diabetes mellitus, insipidus, and granular kidney; further, in all disturbances of water resorption, as in frequent vomiting, in dilatation of the stomach, and in increased excretion of water through the intestines (diarrhea). In all those cases in which a high degree of dryness of the skin is to be looked upon as a sign of imminent heart failure (Asiatic cholera) and in the summer diarrhea of infants, the treatment of the dehydration by means of salt infusions is imperative. These infusions should also be employed in those cases in which the intake of liquids is not permitted, as after operations on the gastrointestinal tract.

If an especially high grade of dehydration exists, the elasticity of the skin is lost so that it may be raised into folds which do not disappear again for several seconds on being released. In the most severe cases the skin feels exactly like parchment.

Facies Hippocratica.—A lessened water content of the skin is a cause of the facies hippocratica. By this one understands the peculiar facial expression, known to the ancients, which points to the severest heart weakness and occurs principally in Asiatic cholera, in other severe intestinal affections, in summer diarrhea of infants, in severe diseases of the peritoneum (as peritonitis), in ileus, but also in pneumonia with unfavorable course. The cheeks are hollow, the eyeballs sunken, the nose pointed, and the nasolabial folds sharply defined. The lessened turgor of the tissue gives a characteristic aspect to infants suffering from gastrointestinal diseases, causing the face to resemble that of an old man. In old age the loss of elasticity is physiological.

Clubbed Fingers.—We have still to consider a change of the skin, diagnostically important, in which in long-standing cases even the bones take part; this can be easily proved nowadays by means of the X-rays. The so-called "drumstick fingers" consist in a club-shaped swelling at the end phalanx of the fingers and toes whereby the nails assume a more or less spherical form. One finds this anomaly in bronchiectasis and in putrid bronchitis, more seldom in empyema of the thorax, cavernous phthisis, and valvular heart lesions. The duration of one of these diseases for several weeks is sufficient for the development of club-fingers. Indeed, one may find this condition entirely developed in infants only a few weeks old suffering from congenital

heart disease. It is a remarkable fact that these changes can undergo retrogression when the irritating cause is removed, as, for instance, after operation for an empyema.

General Remarks on Exanthems.—On inspection of the skin one must bear in mind the acute exanthems and their characteristic residua. The description of the skin eruptions will not be taken up in this book. We must mention, however, that especially after measles one finds a branny desquamation, usually on the trunk, whereas after the course of scarlet fever the desquamation is lamellate and is especially marked on the hands and feet. Not seldom after scarlet fever one may find a veritable glove-finger desquamation; this, in connection with enlarged glands in the angle of the jaw, would suggest that a nephritis is postscarlatinal. Naturally one must not forget to search for signs of syphilis in its earlier and later stages and for the roseola of abdominal and exanthematic typhoid.

From the rash itself one cannot judge of the severity of an acute infectious disease. In severe cases of measles the eruption is sometimes scarcely recognizable owing to the weakness of the heart. It is known that in diminishing heart power, a rash that is already visible may disappear, and this occurrence has led to the expression among the people that the rash has "gone in." A violet color speaks for cyanosis and, therefore, either for severe weakness of the heart or for serious involvement of the respiratory organs.

In scarlet fever the so-called "double exanthem" is considered a mark of a severe case of the disease. Besides the usual rash in scarlet fever, one sees especially on the buttocks and on the thighs dark reddish-brown, slightly raised efflorescences (v. Pirquet).

The hemorrhagic exanthems will be considered *in extenso* in Chapter XIII. It may be again mentioned that especially in measles the presence of a hemorrhagic rash may not always be a sign of a severe case.

Dropsy.—The significance of edema of the skin will be discussed in a special chapter.

B. ANOMALIES OF NUTRITION AND DEVELOPMENT

Following a methodical procedure of examination, after taking up the skin, we have to consider the anomalies of nutrition and development.

I. Cachexia

In the first place we have to speak of cachexia. By this term is understood a specific change which leads to emaciation, loss of strength, and to a characteristic discoloration of the integument. Alterations

take place in the blood involving its total amount and its composition, and finally essential changes of the whole metabolism and of the proteids in particular.

Pronounced cases will be recognized by the experienced observer at the first glance. The recognition of a beginning cachexia, however, may be very difficult and is of the greatest prognostic and diagnostic importance.

Whether the emaciation in carcinomatous patients is due to an oxidation-increasing effect of the carcinoma toxins or whether it is at least in a great part due to complete absence of appetite is an unsolved problem. In any case one finds in the metabolism of carcinoma a constant decomposition of body proteids which can never be entirely prevented, however abundant the supply of food may be. The greatest part of the emaciation in cancer, especially in affections of the digestive organs, may be traced back to the mechanical inability to take food. Greatly emaciated patients suffering from an obstructive cancer of the esophagus, the pylorus, or the intestine, revive for a period of some months after a palliative operation in which the tumor itself had not been extirpated, but the obstacle alone removed. Rapid growth of tumors always gives rise to rapid decomposition of proteids, whereas, especially in old age and in a high grade of marasmus, the metabolism resembles more nearly that of simple inanition in which chiefly fat is oxidized and only a small amount of albumin. If in carcinomatous patients the nourishment is lacking in carbohydrates, those bodies may very easily arise which we find so commonly in diabetic coma. In the urine we find acetone, diacetic acid, and β-oxybutyric acid, but, as in diabetes, we may cause these bodies again to disappear on a diet richer in carbohydrates. As cause of cachectic conditions we must place the malignant tumors first (carcinoma, sarcoma, malignant lymphoma); further, the pernicious forms of malaria and pernicious anemia; then chronic poisoning by lead, mercury, and other metals, sometimes also chronic alcoholism, chronic infectious diseases, as tuberculosis, syphilis, long-standing fevers from other causes, severe heart, liver, and kidney diseases, and putrid myoma of the uterus. In the last case the cachexia, if present, will arouse a suspicion of a carcinomatous condition.

At times one may predicate from the color of the skin which is the organ involved. Cyanosis points to severe heart failure; an icteric or subicteric discoloration to liver trouble; an edematous condition of the skin to the kidneys.

Cachexia does not always develop with the same rapidity. When a uterine myoma decomposes the cachexia develops quickly, while in carcinoma it comes on slowly.

The treatment of cachexia, therefore, is not accompanied by lasting success, because the primary disease is incurable. On the contrary, any improvement of the primary disorder, though only temporary (as in arsenic therapy in malignant lymphoma), will ameliorate the cachexia quite remarkably. We have, therefore, no ground to consider the cachexia itself as a process incapable of regulation.

That emaciation, which, resulting from too little nourishment, plays a prominent rôle in the picture of many cachexias (as for instance in malignant tumors of the digestive tract), may be successfully combated if we can succeed in giving the patients large quantities of food. By this means, even in advanced carcinoma, we can obtain a considerable increase of weight if the passage is restored through a palliative operation.

II. Emaciation

General Remarks.—At first glance our judgment may be deceived as to the state of nutrition, especially in cases of lean individuals with large frames. People with broad shoulders and short wide faces do not appear thin and the high degree of pathological poverty in fat is only noticeable on feeling of the soft parts.

In all cases in which the state of nutrition is important the body weight must be compared with the height; it must not be forgotten that patients with kyphoscoliosis appear smaller than they really are. The blood examination is also deceptive in thin individuals, for the hemoglobin content is found to be normal and at the same time the total quantity of blood undoubtedly greatly reduced, since the blood takes part in the emaciation.

Results of Malnutrition.—If one consults the table of body weights, one may consider 10 per cent. of underweight as still physiological. Malnutrition arises when the calorific output of the organism exceeds the calorific value of the food taken in. The unfavorable results of undernutrition will be further considered in another place. An important factor in the pathology of metabolism must be emphasized: namely, that in undernutrition the organism does not reduce its requirements, but in order to cover the deficit lives upon its own body substance. If a sufficient fat depot is at its disposal, the organism lives chiefly on fat. The worse the state of nutrition the more will the vital body substance be attacked. The patient not only becomes thin, but also weak in muscle.

In acute diseases this does not mean much. During a severe typhoid a patient may lose 20 kg. or more. If he recovers, the well-known voracious hunger (bulemia) sets in, by which the loss of body weight is quickly restored. Of greater importance is the emaciation

in chronic diseases. For the deterioration in nutrition reacts unfavorably on the primary disease, as we see, before all in tuberculosis of the lungs.

If we succeed in sustaining the loss of strength, by hypernutrition, we may see an improvement take place in the ailment.

Light Eaters.—In some lean individuals, we cannot find, in spite of careful examination, any explanation for their poor nutrition. Further investigation into their mode of life generally shows that they nourish themselves insufficiently or improperly, taking too little fat and carbohydrates and a preponderance of meat. Even in childhood one may distinguish good and poor eaters. The latter are very often nervous, precocious children, overzealous in school, in whom, on account of the overfatigue and exhaustion of their nerves, the right appetite does not develop. In such cases the parents consider that their children have weak stomachs and give them a very substantial and easily digestible diet, chiefly of meat. This, again, does not stimulate intestinal activity and leads to constipation which one so often finds associated with "school anemia," anorexia, and emaciation.

Such children need a varied, mixed dietary containing plenty of vegetables and fruit. At a still earlier age, perhaps in the second year, one succeeds, sometimes by simple pedagogical methods, in getting children to eat. In many cases it is of great advantage to allow them to sit at the table with adults; in other children, of a lively and playful disposition, it is advisable to restrain them from all play for a certain length of time before each meal and then to require them to eat alone.

At times undernourishment occurs at a later age on the ground of a neuropathic disposition. Such individuals occasionally develop a nervous affection of the stomach following a dyspepsia in which every abundant supply of nourishment causes discomfort, not really pain, but the feeling of fulness. Therefore, the quantity of food consumed sinks below the amount required to maintain equilibrium. It is necessary in these cases to convince the patients that they are both allowed to eat and are able to eat. Forced feeding may accomplish excellent results. Still the diagnosis of undernourishment, resulting from dyspepsia, should be made only after thorough examination, since a great number of those persons who have no fat reserve suffer from a slowly progressing phthisis.

We shall now consider the indications for combating emaciation.

Therapeutical Indications.—We have first of all to consider pulmonary tuberculosis whose treatment will only be successful when the state of nutrition is improved. Indeed this may be pushed too far and patients suffering from lung diseases are sometimes so much overfed that their heart and respiratory organs suffer anew through their obesity. One must endeavor to substitute proteid for fat in the

dietetic treatment of consumption. For this reason the rest cure should not be pushed too far in patients free from fever. Also in syphilis, in its severe later forms, improvement of the nutrition by dietetic measures has succeeded better than the rigid diet combined with laxatives formerly described.

In chronic hectic fevers of septic and pyemic nature the conservation of strength is of greatest importance. Diabetes mellitus acts differently in this regard. Though the mild form, as in old age, is related to obesity and the uric acid diathesis, the severe form occurring in childhood and up to the thirtieth year, leads rapidly to a high grade of emaciation and muscle weakness. In such cases one must work toward increasing the body weight—a very difficult task in these patients with low tolerance for carbohydrates. The favorable influence of increasing the body weight is remarkable in the course of a diabetes insipidus. v. Noorden reports a very instructive case (Vol. III of the Deutsche Klinik, p. 213): "The patient, fifty years old, had lost 25 kg. in fifteen months. He had been taken ill following a railroad accident. We succeeded, by the enormous supply of 250–300 gm. of fat a day, in attaining an increase in weight of 20 kg. in four months; with this improvement in the nutrition the urine sank to 3–4 liters a day and remained at this relatively low level. The patient felt entirely strong and was able to work." Of great importance is the maintenance of the nutritive state in Graves' disease and in neurasthenic and hysterical conditions.

Weir Mitchell was the first, more than twenty years ago, to show that overfeeding, systematically carried out, succeeded in rendering the nervous system more efficient, and that good results in the functional neuroses were obtained through increase of body weight, no matter whether the malnutrition had existed before or whether it had first developed as a result of the neurosis. Playfair has developed this method further and has worked for its propagation.

In general one must hold to the principle that patients suffering from lung, stomach, intestinal, and nervous disorders derive advantage from the "mastcure," while those suffering from other chronic diseases retain better their small body weight: thus in valvular lesions, myocarditis, arteriosclerosis, aortic aneurysm, kyphoscoliosis, chronic bronchitis, emphysema, bronchial asthma, adhesive pleuritis, chronic articular rheumatism, gout, and all other diseases which lead to difficulty in locomotion or in breathing, as hemiplegias, diseases of the spinal cord, etc.

III. Forced Alimentation

1. **Advisability of Meat Feeding.**—In general the proteid catabolism is subject to the same variations as the supply of proteid. The or-

ganism oxidizes the total amount of proteid contained in the food. Still there are conditions under which there is a deposit of nitrogenous material, or proteid, *i.e.*, muscle: namely, in youth, as long as the organism is growing; further, after consuming diseases when, as for instance after typhoid fever, the body has to regain its original proteid content, when single organs are in rapid growth, and finally when, as a result of strenuous muscular work, a hypertrophy of the whole musculature takes place. Aside from these unusual conditions just mentioned the question arises, whether, in healthy persons not previously reduced in flesh, a retention of nitrogenous material is possible. Krug, a pupil of v. Noorden, in a self-experiment, acquired through a large supply of carbohydrate and fat a considerable nitrogenous deposit, having previously placed himself in nitrogen equilibrium; Bornstein arrived at the same results, having merely increased the amount of proteids in his food.

It is not yet finally decided whether the increase of calories in the form of nitrogenous or nonnitrogenous food is the more suitable to form flesh. According to an experiment of Dapper, it would appear that the nonnitrogenous merits the preference.

In practice, however, as Magnus-Levy emphasizes, it would be sometimes of great value if, through increase of proteid, we could induce a deposit of nitrogenous substances, however slow the process might be. In the case mentioned above, Bornstein has in fact accomplished this. Still it is recognized that we cannot generalize on the results of metabolism experiments in a single case, since great individual variations occur. It would be well if we could increase the flesh of persons already well nourished, without enlarging their fat balance, according to Bornstein's method. In debilitated patients an increase in both fat and proteins is desirable.

As to the sort of protein bodies which are best suited for this diet-cure, it has been stated that the phosphoric protein bodies, especially casein, are best adapted to increase the nitrogen deposit. Thus an infant (the human organism in the period of the most intense growth) receives its albuminous food for the most part in the form of casein; but metabolism experiments, undertaken to decide this question, have not brought about uniform results.

There is no question that an abundant protein diet is of great value in improving the state of health, as far as a weakened organism is concerned. On the other hand, in respect to the healthy organism, the question is not yet finally decided. Pflüger holds that every addition of protein above the nutritive requirement produces an increase of metabolism and of the functional capacity of the individual. But he is inclined to believe that the value of the increased supply of proteins increases only to a certain limit,

Is the quantity of body protein gained through overfeeding a lasting gain? It is a fact often observed clinically that the results of overfeeding last only a short time—only a few weeks or months—though a patient takes the same quantity of food which, before the cure, was sufficient to keep his small amount of body substance in equilibrium. Voit explains this in this way: that an increased protein content is also followed by an increase of the protein metabolism. It is, therefore, only possible to maintain the nitrogenous equilibrium by constantly increasing the supply of nitrogenous material, except in those cases with a tendency to lay on body substance.

2. **Value of the Various Foodstuffs for Anabolism.**—If the supply of food is greater than the consumption, anabolism results. However, this deposit does not correspond to the whole increase, for also in digestion the work performed varies in different individuals, and must be subtracted from the total gain in energy. It is therefore impossible to determine in advance how great the deposit will be after an increase of food.

Fat.—An increase of fat in the diet is generally very favorable to the increase of body substance; even if given in large quantities, 97–98 per cent. of the fat is deposited.

Carbohydrates.—With carbohydrates, especially if not broken up, the work of digestion is incomparably greater; also the transformation of carbohydrates into fat, in which form they are finally deposited, is followed by a loss of energy. Neglecting these two factors, we find that the gain resulting from the use of carbohydrates always rests one-third smaller than our theoretical calculation.

Proteins.—The most unsuitable food for the laying on of body substance is proteid; for, in the first place, it is very difficult with purely albuminous food, especially with meat, to incorporate the necessary number of calories; and, secondly, the catabolism increases on the plentiful use of albumin. We must analyze this latter fact a little more in detail. Magnus Levy has shown that a meal rich in proteins increases the amount of oxidation for a few hours. But of greater importance is the gradually increasing consumption of energy on overfeeding with proteins, the so-called secondary increase of energy consumption through protein feeding (Rubner).

If one concedes that the increased demand on energy is due to the development of protoplasm and not to the gain in body weight, nevertheless the increased demand on energy cannot be explained by the gain in living protoplasm brought about by the protein overfeeding, for this gain can also be accomplished through the supply of nonnitrogenous material; the plus of energy consumption will then be smaller (v. Noorden). We must, therefore, necessarily infer that the supply of proteins has the effect of an irritation upon the cells

of the organism, resulting in an increased metabolism. In every kind of overfeeding there is a certain small increase in the transformed energy. For augmentation of the body weight calls forth an increased consumption of energy, not only during motion, but also during rest, since the working power of the heart and the respiratory muscles must be greater.

3. **Peculiarities of Convalescence.**—Special conditions arise in convalescence after exhaustive diseases of long duration. The best example of this is typhoid fever. First we find very low figures for oxygen consumption, which may be interpreted as an expression of the weakened condition of the whole organism (Svenson and Fr. Müller); however, the oxygen consumption rises and reaches values which are one and one-half times as large as the normal. Also the increase in the consumption of energy is, in this period, much larger than normal as a result of motion and the increased food supply.

Nevertheless, one often sees patients convalescing from typhoid fever gain surprisingly fast in weight. This fact explains itself through the ravenous appetite following typhoid fever. Quantities of food are sometimes consumed, which mean a supply of 80, even 90 calories per kilogram of body weight: conditions resembling those in the period of infancy, and indeed unheard of in adults.

4. **The Mast Cure.**—It is clear that methodical overfeeding, together with absolute rest in bed (mast cure), benefits, in the first place, the stock of fat of the body, which is the reason that many authors deny its value entirely. Von Noorden properly emphasizes that success in strengthening the patient is greater if one begins soon with muscular exercises. In many cases we have desisted from the constant rest in bed and obtained full success by putting the patients to bed only for a few hours during the daytime. The value of muscular action for the building up of living protoplasm is well demonstrated by the investigations of Zuntz and Schumburg; they accomplished this result by gymnastics, systematically practised, even when a loss of fat occurred in consequence of a deficit in the complete metabolism. The same thing may be observed after mountain climbing for several weeks. The mountain climbers increase in strength, at the same time loosing in weight, but there is no doubt that their health has improved in spite of this loss of weight.

Von Noorden calculates from a great material the following average values in regard to the increase of body weight resulting from a mast cure:

Daily Surplus of Food	*Weekly Increase in Weight*
500– 800 calories	600–1000 gm.
800–1200 calories	800–1200 gm.
1200–1800 calories	1200–2000 gm.

These figures may be variously altered by the fact that there exists also a "false increase in weight," that is to say, one depending on an infiltration of tissues with water. One often sees such sudden jumps in the weight figures as cannot be interpreted in any other way. This phenomenon is readily explained if one examines the chlorid balance of the organism. We find in connection with the sudden increase in body weight a retention of the chlorids, a sufficient proof of the retention of water.

Overfeeding is indicated first in phthisis; further in certain forms of anemia and neurasthenia. While Debove, in his mast cure, tried to introduce the necessary quantity of food by means of the stomach-tube, to-day one aims to accomplish the same thing by the natural ingestion of food.

(*a*) Weir Mitchell Treatment.—The method of overfeeding has been systematically developed by Weir Mitchell. He took the patient out of his environment, brought him if possible into a sanitarium, in order to consign him entirely to the influence of the physician and to remove him from the influence of his daily life. The treatment starts with absolute rest in bed and an exclusive milk diet, to which a mixed diet is soon added. Exercise is substituted by massage and faradization.

(*b*) Burkart's Modification.—Burkart has introduced this treatment into Germany with modifications. He combines the following menu for the second week of the treatment:

7:30 A. M.: One-half liter milk, 2 zwiebacks.
8:30 A. M.: Coffee with cream, 80 gm. meat with butter and baked potatoes.
10:00 A. M.: One-fourth liter milk, 3 zwiebacks.
12:00 M.: One-half liter milk.
1:00 P. M.: Bouillon with egg, 200 g. meat, potatoes, vegetables, 126 gm. stewed prunes, sweets.
3:30 P. M.: One-half liter milk, 2 zwiebacks.
5:30 P. M.: One-third liter milk, 2 zwiebacks.
8:00 P. M.: One-half liter milk, 80 gm. meat, bread and butter.
9:30 P. M.: One-third liter milk, 2 zwiebacks.

Upon such a diet, a daily supply of 3642 calories, he keeps the patient for four weeks, arriving at this quantity gradually during the first week.

Alcohol as Food.—In regard to the supply of alcohol, the addition of cognac to milk and the use of beer in moderate quantity may be sometimes employed to advantage. It is not so much the supply of more calories which is desired, but the exciting effect of the alcohol on the central nervous system, which permits a larger absorption of

food, especially in those persons who use alcohol habitually. In using alcohol as food we must guard against establishing a habit in those unaccustomed to its use (A. Hofmann).

Koumiss and Kephir.—A very efficient form of overfeeding is accomplished through the drinking of koumiss and kephir. Mares' and cows' milk, respectively, are brought to fermentation by kephir bacilli (Dispora Caucasica); the final products are lactic acid and alcohol. Kephir contains, according to Rubner, 3.1 per cent. of proteid, 2 per cent. fat, 1.6 per cent. lactose, .8 per cent. lactic acid, and 2.1 per cent. alcohol. Koumiss, highly esteemed as a food, especially in Russia, has a similar composition.

We distinguish three kinds of kephir: that which is one day old tastes sweet and has a laxative effect; that three days old is constipating, and that two days old is intermediate in its action. A glassful of kephir is given three to four times a day between meals for four to six weeks, and it is possible in this way to add still 1 to 1 1/2 liters to the usual diet.

(*c*) Overfeeding According to Hirschfeld.—According to Hirschfeld's statement, one may, by greatly increasing the supply of fat alone, succeed in increasing the daily number of calories to 4000; the body weight rises in the first week enormously. The nutrient fat has to account for three-quarters of the total increase in weight.

(*d*) Overfeeding in Phthisis According to Dettweiler.—Dettweiler values forced alimentation more highly than a change of climate in phthisiotherapy. Experience indeed shows that pulmonary affections pursue a more favorable course if sufficient nutrition is provided, even in the absence of good air. There are two obstacles to overcome in the nutritive treatment of phthisis: the diminished appetite and the tendency to digestive disturbances.

The best success in combating the anorexia will be obtained by psychical influence. It must be explained to the patient in a delicate way that it is only a sufficient quantity of food that makes it possible to bring about his recovery. Further, the right choice of diet is important: it should be varied. Dettweiler is right in asserting that it is a disadvantage if the patient knows his menu in advance. Frequent but small meals, consisting of as many courses as possible, should be given; each meat course should be followed by vegetables supplying cellulose, fat, and carbohydrates.

The dyspepsia of consumptives is often of nervous origin; this means that the motility and secretion of the stomach are not disturbed, but that the normal process of digestion incites disagreeable sensations, as the sense of repletion, of pressure in the epigastrium, etc. Sometimes swallowing of the sputum has an unfavorable influence on digestion. In these cases the administration of carbonate of creosote in

small doses may be followed by excellent success, and we therefore agree entirely with Klemperer that the creosote often acts as a stomachic.

In the following we give two bills of fare taken from Dettweiler in v. Leyden's "Treatise on Therapy by Nutrition:"

I. AFEBRILE PHTHISICAL PATIENTS WITH GOOD APPETITE

	8:00 A. M.
1 cup half milk (65 c.c.), half coffee.	5 zwiebacks.
1 glass of milk (210 c.c.).	12.5 gm. butter.
1 small piece bread.	40 gm. honey.
	10:00 A. M.
2 eggs.	1 small piece bread.
1 glass milk.	12.5 gm. butter.
1 biscuit.	
	1:00 P. M.
1 piece bread.	1 small cutlet.
5 tablespoons noodle soup.	1 piece roast chicken.
1 1/2 tablespoonfuls of fish.	1 1/2 tablespoonfuls compote.
2 tablespoonfuls of potato.	1/2 piece of cake.
10 gm. butter.	1 fig.
1 piece beef.	2 pieces sugar dipped in coffee.
1 spoon beans.	2 glasses Rhine wine.
	4:00 P. M.
2 glasses milk.	
	7:00 P. M.
3 tablespoonfuls thick soup.	1 spoonful potato salad.
1 piece roast beef.	1 small piece bread.
1 piece boiled ham.	1 spoonful sauce
3 pieces smoked tongue.	1 glass Rhine wine.
	9:00 P. M.
1 glass milk.	

Total: 3394 calories.

II. YOUNG GIRL WITH HIGH FEVER, BEDRIDDEN FOR MONTHS

	8:00 A. M.
1 cup coffee (half milk).	1 biscuit (32 gm.).
1 piece sugar.	2 glasses milk.
	10:00 A. M.
2 glasses milk.	1 biscuit.
1 glass Marsala wine.	
	1:00 P. M.
1/2 plate soup.	1 piece roast goose.
1 small piece beefsteak (40 gm.).	2 spoonfuls sauce.
2 plums.	1 glass Marsala wine.
1 small piece boiled ham.	
	4:00 P. M.
2 glasses milk.	
	7:00 P. M.
1/2 plate thick soup.	2 spoonfuls potato salad.
1 piece roast rabbit (56 gm.).	1 glass Marsala wine.
	9:00 P. M.
2 glasses milk.	

Total: 2505.9 calories.

(*e*) Mast Cure of v. Noorden.—According to our experience, a larger quantity of carbohydrates cannot be tolerated for a long period without causing anorexia; therefore v. Noorden emphasizes giving the plus of calories in the form of fat.

He composes a diet as follows:

120–130 gm. proteid = 490–530 calories.
300–350 gm. carbohydrates = 1230–1435 calories.

These 1720 to 1965 calories represent about the food requirements necessary to maintain equilibrium. By the addition of fat in the form of milk or cream and butter one may easily increase this amount. He also economizes the fat by the use of alcohol, 9.3 gm. alcohol protecting 7 gm. fat against combustion.

(*f*) Diet Cures in Nervous Diseases.—*Graves' Disease.*—Of nervous diseases which yield to dietetic treatment, Graves' disease may be mentioned first. By exact metabolism experiments it has been proved, something anticipated by clinical observation, that the calorie consumption in Graves' disease is exceedingly high and may be twice that of the normal. There exists a certain connection between the quantity of oxidation per kilogram body weight and the gravity of the disease, in the sense that remissions are always associated with a decrease in the quantity of decomposition, while exacerbations considerably increase this value.

The elimination of nitrogen reaches abnormally high figures, resulting in a deficit, though the supply of food and even of proteins would be sufficient under normal conditions. It can be proved in two ways that this disintegration of proteins is, in fact, the effect of hyperthyroidism:

1. The increased metabolism of albumin sinks considerably if thyroidectomy is performed (this has often been done with good results).

2. This same protein metabolism rises again at once if the patient on whom thyroidectomy has been performed receives the extirpated thyroid gland internally in powder form (Matthes).

In the therapy of Basedow's disease nutrition plays the chief part, as Nothnagel has emphasized repeatedly. He has seen no advantage derived from a one-sided form of diet, even from a vegetable diet, and attaches the greatest value to abundant mixed food. Alcoholic beverages have, of course, to be abolished on account of the existing tachycardia.

Neurasthenia.—The importance of a dietetic therapy in functional neuroses was first rightly estimated by Weir Mitchell. But at present the original form of his method has undergone modification. In the first place, the introduction to his treatment by an exclusive milk

diet for several days is omitted, since many patients express a dislike for it. Binswanger starts with the following diet:

1. Meal, 7:00 A. M.: 250 gm. milk (boiled) or cocoa (boiled with half and half milk and water), 2 to 3 biscuits or zwiebacks.

2. Meal, 9:00 A. M.: 1 cup bouillon, 20 gm. graham bread or toast, 10 gm. butter.

3. Meal, 11:00 A. M.: 125 to 175 gm. milk, with 1 tablespoonful malt extract (or the yellow of 1 egg).

4. Meal, 1:00 P. M. 80 to 100 gm. soup, with oats, barley, rice, etc., 50 gm. roast meat, 10 gm. potatoes, 7 to 10 gm. vegetables, 20 gm. rice pudding, and 50 gm. fruit sauce.

5. Meal, 4:00 P. M.: Weak tea or milk with malt extract or cocoa (125 gm.), 2 biscuits.

6. Meal, 6:00 P. M.: 20 gm. meat (roasted, warm or cold, scraped raw meat, ham, tongue, etc.), 10 gm. graham bread or toast, 5 gm. butter.

7. Meal, 8:00 P. M.: 125 gm. soup with 10 gm. butter, the yellow of 1 egg, and barley or oats.

8. Meal, between 9:30 and 10:00 P. M.: 125 gm. milk with malt extract. Gradually one doubles and even triples these portions.

Psychoses: Metabolism.—In the acute forms of psychosis (mania, melancholia, etc.) the body weight sinks rapidly in consequence of the altered metabolism, but in convalescence it quickly reaches its former height. Improvement without such an increase of weight is usually only temporary, while, on the other hand, increase of weight alone without simultaneous improvement of the psychical condition makes us fear that the psychosis is changing into the secondary chronic form (idiocy).

In psychosis, the emaciation is caused by insufficient nutrition, the appetite being decreased, which may go so far that the patient absolutely refuses food (sitophobia). This condition of inanition aggravates the psychosis further. In the state of excitation we have in addition to reckon with the restlessness, the sleeplessness, and, in grave cases, the incessant strong muscular movements. Since increase or decrease in body weight not seldom precedes alterations in the disease, we cannot, therefore, attribute merely secondary importance to these changes.

In all those psychoses, which at present we believe to be the sequelæ of exogenous intoxications or autointoxications, the changed metabolism may be explained as a direct sequence of the toxicosis. In a great many psychoses, however, we have at present no evidence of such an origin, and we are obliged to conclude that these psychical disorders themselves exercise an influence directly upon the metabolism in the same way that psychically healthy individuals are influenced in regard to their state of nutrition by mental emotions, such as grief.

Further, we have to keep in view the relations between gastrointestinal disturbances and psychical disorders; thus, for instance, the hypersecretion of the stomach may bring about hypochondriacal melancholia; on the other hand, in states of depression secondary hypersecretion and hyperchlorhydria may develop (v. Noorden).

Therapeutic Measures.—If with patience and individual psychic treatment one does not succeed in getting the mentally affected person to take the necessary quantity of food, then it is advisable not to wait longer, but to feed with the stomach-tube. One can easily feed them twice a day with 1 1/2 liters of milk with three eggs beaten in; this is just enough for patients who are lying in bed and protected against any loss of heat (F. Jolly). If the patient vomits after this supply of food, one may try, and generally with more success, giving half of the above-mentioned quantity four times a day. Sanatogen, eucasin, nutrose, somatose, etc., may be advantageously added to the milk.

Technique of Feeding with Sounds.—The passing of the sound is best done through the nose; for if one wants to do it through the mouth, a Heister speculum (mouth-gag) must be used before, a procedure sometimes quite troublesome. Care should always be taken that the head is well fixed, the nurse standing at the head of the bed, holding the temples of the patient with both hands. Hereupon the speculum is applied, after which a wooden wedge is inserted between the teeth, and finally the sound is passed, the guiding finger being protected by a metal cap. In such cases the enema is less useful than usual, since the patient with sitophobia also refuses this manner of feeding and forces out the food introduced. In general, a mixed regimen is indicated in psychosis, unless other affections are present at the same time which demand special diet, as a puerperal process in an acute psychosis, which has developed post partum.

IV. Obesity

1. **Definition.**—By obesity we understand an abnormal development of the fat depots of the organism, resulting in morbid changes in the functions of the different organs, and finally of the whole organism.

What is Pathological Corpulence?—In mild cases of obesity it is often difficult to draw the line between the physiological and the pathological condition, chiefly because the average values which have been determined for the different ages vary very much according to the profession, mode of life, and race. W. Ebstein ("Obesity," Vol. III of the "Deutsche Klinik") states that we may distinguish three different stages in the development of obesity. In the first stage we are prone to envy the persons in question, in the second they seem ludicrous, in the third they excite our compassion.

Relative Obesity.—A degree of obesity which still impresses us only as a condition of comfortable stoutness may sometimes produce noxious results. v. Noorden has created for such instances the term "relative obesity." He comprises under this term mild cases of obesity which, owing to a particular constitution, as, for instance, functional incapacity of the heart, would be greatly benefited by a reduction of the panniculus adiposus. Undoubtedly certain troubles become more annoying if at the same time obesity, even in a lesser degree, is present. An emphysematous patient, who reduces part of his fat cushion, becomes thereby much more capable of work. The same is true of patients who, as subjects of paresis or of articular affections, are hardly able to walk.

2. **Complications in Obesity.**—*Diabetes mellitus; Uric Acid Diathesis; Anemia.*—The relation of obesity to other constitutional disorders, if not quite clear, can certainly not be denied. Naunyn emphasizes that the rather benign forms of diabetes, which develop at an advanced age, occur chiefly in corpulent persons; also the uric acid diathesis has an intimate connection with obesity; we find not rarely attacks of gout in subjects who, in the first stage of obesity, do not at all give us the impression that they are sick. In the higher degrees of general obesity a very marked anemia is present almost constantly and can for itself in turn cause an increase in the fat depots of the body. It is generally known that subjects of chlorosis incline to obesity, and nothing would be more wrong than to conclude a good state of the blood from a tense, well-developed panniculus adiposus.

Inspection of the different mucous membranes in such cases serves as a guide, when the cheeks deceive us by their florid complexion, an anomaly of the vasomotor nerves. Of course, in important cases the final decision rests only on a careful blood examination.

Arteriosclerosis; Constipation.—Further, an important complication of obesity is arteriosclerosis, which has a more direct connection with the uric acid diathesis than with obesity as such. Very often subjects of obesity suffer from constipation. There arises thereby a circulus vitiosus, the ingested food being absorbed to the greatest extent due to the constipation, this constipation being again increased by the corpulence, the retarded circulation, and the venous stasis.

3. **Clinical Picture of Obesity Threatening Life.**—*a.* Circulatory Disturbances.—The fate of subjects suffering from severe obesity is, in the first place, dependent on the state of their circulatory system. It must be mentioned that obesity may become indirectly the cause of death in quite a number of cases, and the pitiable patients die from slowly developing cardiac insufficiency, which may reach the highest degree.

Pathological Physiology.—The power of the heart suffers in general obesity in the first place from fatty infiltrations originating in the

subserous adipose tissue, which infiltrate the myocardium along the cardiac vessels and little by little take its place. In this way that diseased condition of the heart results which Kisch called "Mastfettherz" (fatty degeneration of cardiac muscular tissue). The energy of the systole suffers in this way since dead masses are deposited in the contractile muscle substance, and at the same time the unyielding mantle of fat, which encloses the heart, severely hinders diastole. On the other hand, a greatly increased functional power is expected from the heart, for every movement of the body is followed by a larger expenditure of strength of all the voluntary muscles and of the heart; the circulatory area is extended a great deal, for a narrow network of blood-vessels penetrates the continuously spreading adipose tissue and long capillary vessels are present in abundance, whereas the larger afferent and efferent vessels are only small in number. The excursion of the lungs is decreased and by this the aspiration of the venous blood to the right auricle is unfavorably influenced. The mediastinum, the diaphragm, the abdominal organs, the thoracic and abdominal walls all carry big masses of fat which become a burden to each respiratory movement. Therefore, a more superficial, if also a more frequent, respiration results.

Findings in the Circulatory Apparatus in Subjects of Obesity and of Plethora vera.—As a consequence of the above-mentioned conditions, which are a constant drain upon the reserve power of the heart, there results, in the first place, not a dilatation, but a hypertrophy of the heart, provided that the general condition is good. This announces itself, according to v. Noorden, by an accentuation of the second aortic sound, which at first seems increased only on muscular exertion, but later even during muscular inactivity. In this stage the apex beat is in the normal place and not heaving. The outline on percussion is normal or slightly extended to the right, a phenomenon satisfactorily explained by the aggregation of fat over the right ventricle and the apposition of the mediastinal fat. The sounds are generally somewhat soft but pure. Gradually the symptoms of arteriosclerosis appear and with them the signs of a developed hypertrophy of the left ventricle. In plethoric corpulent persons one may observe sometimes in early years, before the fortieth year, a well-developed arteriosclerosis in the peripheral arteries. Sooner or later exhaustion of the cardiac force occurs, as in all diseases which lead at first to hypertrophy. The time of this unfavorable change is dependent on the training given the cardiac muscle by suitable movements and on abstinence from noxæ, as alcohol, coffee, and tobacco. This paralysis of the heart power is hastened by simultaneous diseases of the respiratory organs, by granular kidney, diabetes, and all consumptive diseases.

Anemic Obesity.—If hypertrophy of the heart does not develop

because the heart is insufficiently nourished, then cardiac weakness governs the clinical picture from the beginning; one finds this process especially in anemic corpulent persons. On the slightest muscular exertion, they suffer from dyspnea, exhaustion, and palpitation and have a tendency to fainting spells and collapse. In such cases the examination of the heart shows the following findings: the heart impulse is very weak; there exists enlargement of both sides, partly at least due to dilatation. The frequency of the heart action is very labile and increases considerably on the slightest muscular action or on excitation. The pulse may be entirely irregular or allorrhythmic in type (as pulsus bigeminus). In cases of anemic obesity with atheroma of the coronary arteries, attacks of stenocardia (angina pectoris) may be observed. Bradycardia, if very pronounced, is always to be regarded as a serious symptom of unfavorable prognosis.

The Aspect of Obesity in Advanced Stages.—Following v. Noorden, we have distinguished above two forms of cardiac disturbances in the course of obesity, differentiated by the number of heart muscle fibers which remain capable of function: the fatty heart of muscularly strong individuals, which passes through a state of compensation, and the anemic fatty heart which from the beginning is deficient in action. This differentiation observed at onset remains also in the later stages of the disease.

The hypertrophied fatty heart becomes crippled little by little. There follows an engorged liver and venous stasis, bringing about hemorrhoids and varices on the lower extremities, and in this way a clinical picture slowly develops, which we are used to see in uncompensated valvular lesions. In common with them, the disease in question responds promptly to digitalis.

Very rarely there arises an acute insufficiency of the heart with fatal termination; often the patients are obliged to live through the whole dreary drama of slowly beginning insufficiency with dropsy and orthopnea, occasionally quickly terminated by an intercurrent cerebral hemorrhage or embolism of the lungs. Quite different is the course of the disease in the anemic type. These patients are themselves entirely convinced of their very small functional capacity, though some for a long time may be misled by their feeling of energy. In consequence of the anxious care they take of it, the heart performs the minimal quantity of work until the end. Therefore, the more easily may an intercurrent disease or a necessary exertion lead to a fatal collapse.

Obesity and Heart Diseases.—If an excessive laying on of fat is harmful even to a previously healthy heart, its pernicious influence becomes still more evident in diseases of the heart and blood-vessels, first explained by Oertel. For the prognosis of heart lesions the state

of nutrition is of great importance. Corpulent persons are much earlier subjects of broken compensation than slender people; but in the insufficiency of corpulent people we never meet with that severe degree of cardiac debility which we meet with in thin people. In the latter the heart gives way only when it is so severely injured that it is no longer able to perform its function, notwithstanding the favorable circulation. Therefore the prognosis of cardiac insufficiency is far better in obesity since one may continually reduce the fat through a proper diet and in this way improve the conditions for circulation. In thin patients, on the other hand, we have, to use a metaphor, no more ballast to throw overboard to set the heart again afloat.

b. Diseases of the Respiratory Organs.—The muscles of respiration are impaired in their function by the accumulation of fat in the mediastinum, in the abdomen, in the walls of the trunk, and in the diaphragm. The respiration becomes superficial and consequently more frequent. If the heart with its reserve power is unable to make the blood arterial, dyspnea and subjective air hunger as well as cyanosis and involvement of the auxiliary muscles will result. In this way chronic bronchitis develops, which, having originated as an acute intercurrent disease, heals only with difficulty because the ventilation in the congested lungs is insufficient. The usual methods of treatment (therapeutic, inhalations, etc.) have success in such cases only if at the same time we combat the obesity. Following the chronic bronchitis a catarrhal pneumonia, a slowly progressing influenza, with insidious course, or a tuberculosis of the lungs may develop. Volumen pulmonum auctum is a constant sequela which soon changes into substantial emphysema.

As to tuberculosis of the lungs in obesity, it was believed until recently that these two diseases excluded each other, but this is not true in many cases at least (Queyret). In corpulent persons suffering from phthisis one finds the tendency to the ulcerative form. The bad ventilation of the lungs, the lowered function of the heart, and the anemia, so common in obesity, all help to make the aspect of the disease a serious one.

c. Digestive Organs.—In regard to the relations of obesity to threatening symptoms of the digestive organs we may be brief. In the first place, the difficulty of diagnosing a carcinoma of the digestive tract in corpulent persons must be recognized; palpation of tumors of the abdominal organs is not only very difficult, but it is sometimes not easy to decide if cachexia is present. At any rate it is a suspicious circumstance if corpulent persons of advanced years complain of gastric troubles and at the same time become anemic and muscularly weak, even if no considerable loss of weight is present.

Necrosis of Adipose Tissue and of the Pancreas.—While other

diseases of the abdominal organs, as diabetes mellitus and cirrhosis of the liver, have to be interpreted as maladies which are coordinate with obesity and of similar pathogenesis, the following morbid condition seems to have another significance. Fat necrosis is found in the subperitoneal fat and chiefly in the pancreas; it favors the occurrence of hemorrhages (pancreatic apoplexy), which may be the immediate cause of death. This danger seems to exist only in a small number of cases as one finds fat necrosis relatively often as an accessory finding on postmortem examination. Sticker explains its connection with obesity in the way that the mesentery, loaded with big masses of fat, by dragging, leads to little ruptures at its root; thus necrotic foci as well as extensive hemorrhages arise. A diagnosis is possible only in protracted cases, and even in these it is doubtful.

We have to think of this process if, in corpulent individuals, with intense epigastric pains of colicky character, vomiting, diarrhea, collapse, and a fluctuating tumor in the pit of the stomach appear (Fraenkel). Only the finding of necrotic shreds of pancreatic tissue in the stools, which may be the case after adhesions and perforation of the intestine, enables us to make an unquestionable diagnosis; the occurrence of glycosuria may be considered only as a helpful, but secondary, symptom.

d. Urinary and Sexual Organs.—Obesity for itself scarcely brings about serious symptoms on the part of the urinary apparatus; but if the fat formerly acquired disappears, the kidneys, especially the right one, may lose their natural support and become movable. Serious manifestations, such as kinking of the ureter, hydronephrosis, or incarceration result only rarely. The engorged kidney is the result of the circulatory disturbances which follow obesity; contracted kidney, if genuine or of arteriosclerotic origin, has no direct connection with obesity, but is the result of chronic alcoholism so common in corpulent persons. Very fat women, before or at the beginning of the menopause, may suffer from very persistent and severe hemorrhages which occasionally lead to grave anemia. The disturbances of circulation generally present in obesity may have some influence in bringing about this dysmenorrhea; often the gynecological examination, which should never be neglected, will enable us to discover another anatomical cause for it (myoma, uterine apoplexy, carcinoma). It is also a known fact that corpulent women reach the climacteric period earlier than other women, the difference sometimes being as much as ten years. There is in this a certain analogy to the impotence of very corpulent men. In most cases of obesity the mammary glands, especially in women, participate to a remarkable degree. If the enlargement becomes enormous, it may cause great discomfort and lead to weeping eczema on the undersurfaces and on the portion of the thorax covered by the glands.

4. **The Diagnosis of Obesity.**—The diagnosis of well-developed obesity is generally made at first sight. Inspection and palpation of the naked body allows us to differentiate an excess of subcutaneous fat from hypertrophy of the musculature. In a fat person the tissue is spongy, bulging laterally, and at the same time is pendulous; the relief of the muscles becomes obliterated. The points of predilection for the deposition of fat are the submental region, the cheeks, breasts, abdomen, buttocks, and thighs. The striæ on the skin of the abdomen, sometimes also of the thighs, are important for the recognition of an acutely developed deposit of fat. In this way we may also conclude that a high degree of corpulence has once been present, since the striæ persist as after pregnancy.

5. **General Prognosis in Obesity.**—If obesity is not appropriately combated by therapeutic measures, it becomes a chronic, very slowly but steadily advancing ailment, which generally shortens the duration of life; the experience of the life insurance companies shows this. By no means can the prognosis be made from the body weight of the patient, but the different factors, such as age, heredity (diabetes, apoplexies), mode of life (abuse of alcohol), occupation, behavior in physical performances, etc., have to be kept in mind.

According to A. Hägler, subjects of obesity have to be excluded from insurance if they show irregularity or slowing of the pulse, if they live improperly, drink heavily, or come from families in which apoplexy or diabetes is frequent. At all events a weight of more than 530 gm. for each centimeter of length is suspicious. It is a very important fact that obesity lowers the resistance against acute infectious diseases, so that such patients often die from infection.

6. **The Metabolism of Obesity.**—Before we turn to the therapeutics of obesity it is necessary to mention the chief points in the real nature of this metabolic disturbance. It is plain that overfeeding leads to obesity from the excess of the supplied calories above the number required, but clinical experience shows that people may also suffer from obesity who do not eat an abnormally large amount and who have not lessened their caloric requirement by inactivity. It is important in such cases to decide if in fact we have to deal with a "retardation of metabolism"; *i. e.*, with a decreased splitting capacity of the protoplasm. In studying this question two methods have been used: First, the calorific value of the food consumed, the loss of calories in urine and feces, and the C and N metabolism are determined; in the other the oxygen consumption is examined. Thereby it becomes clear that extraordinary difficulties exist in answering this problem. It is of course entirely impossible to compare one kilogram in a fat man with one in a thin man, since fat represents a nearly lifeless deposit and the portion of living protoplasm cannot be estimated;

on the other hand, the differences in decomposition are small and it is only after months and years that a large deposit of fat will result. According to our present knowledge, we can only say that during rest and on an empty stomach a decreased power of decomposition has by no means been proved in obesity; that the increase of decomposition on muscular exertion is certainly not less in a corpulent person than in a thin one, but that the resorption of food in obesity increases the processes of oxidation to an extraordinarily small degree (Jaquet and Svenson).

Certain conditions point, however, to a pathologically reduced faculty of oxidation, as the obesity of early childhood, the inherited corpulence of some families, and the tendency of certain races to corpulence (Dutchmen, Jews). Experience further shows that castration leads in men and animals to the deposition of fat. This may also be observed in the physiological atrophy of the female generative glands at the climacteric. One may have the conception that the genital glands, like the thyroid, possess the faculty of increasing the oxidation; but on the other hand, the lessened activity and muscular exertion may lead to the same result. A. Loewy and P. Fr. Richter observed that the consumption of oxygen gradually sank about 20 per cent. after castration; after ovarian extract was administered it rose again; spermatic extract caused no effect. Though this proves that obesity may be caused by retardation of metabolism, one is not, therefore, justified in concluding that this is the salient point in the abnormal metabolism of fat, as other animal experiments seem to prove the contrary. Kellner and Köhler found that fattened oxen (castrated) need a larger supply of food to maintain their equilibrium than those not fattened. We wish still to mention the following points in regard to obesity:

1. The fat person is better protected against loss of proteins than the thin one since an ample stock of substances which economize proteins is always at his disposal.

2. The uric acid and carbohydrate metabolism sometimes show anomalies, and may lead to the uric acid diathesis and alimentary glycosuria.

3. An overheating of the body caused by an increased external temperature or by muscular action must be prevented by an increased loss of water through the skin. But under normal conditions no difference exists between fat and thin persons in regard to their loss of water as vapor (P. Fr. Richter).

7. **Treatment of Obesity.**—The ideal in the treatment of obesity is reached if the living cell material is retained while the ballast of superfluous fat is removed.

General Remarks; Dietetic Treatment.—How much shall we reduce

the food in this antifat treatment, and which nutritive ingredients shall be excluded? Rapid loss of weight is accomplished only if the calorific value of the food supply is largely reduced; 1200 to 1500 calories, only half of the calorie requirement for the adult, are permitted. Such a subalimentation, however, cannot be endured for a long period without being harmful. The same goal may be reached more slowly, but with more regard to health, if 1600 to 1800 calories are supplied daily.

In calculating the calorie requirement per kilogram body weight, one will have to bear in mind that from a tenth to a seventh of the weight is, in fact, dead substance. To succeed with this treatment the quantity of the food is more important than the quality, though it will of course be easier for the patient if one gives foods which, of large volume and low calorific value, are very little nourishing and yet satisfy the appetite. Coarse cellulose answers this purpose the best (radishes, cucumbers, cabbage, etc.).

Since the preservation of the protein equilibrium is of the greatest importance, it remains to be decided whether the reduction shall comprise the fats or the carbohydrates or both. One shall under no conditions go below the usual quantity of proteins (120 gm.); on the contrary, it is advisable to increase this, since a large supply of protein may start an increased protoplasm metabolism. However, in the prolonged antifat treatment, even if slowly performed, one never succeeds entirely in avoiding a loss of proteins (v. Noorden and Dapper). Carbohydrates are better protein economizers than fat and are preferable to fat in the dietetic treatment of obesity, because their calorific value is lower and twice as large a quantity may be given.

Dehydration Cure.—Oertel and Schweninger have emphatically called attention to the methodically carried out restriction of liquids as a favoring factor in the cure of obesity. Although this cure is certainly of value in treating disturbances of circulation, as an antifat treatment it is of little effect. For the fat metabolism cannot be increased by withholding liquids, as Salomon's metabolism experiments have shown. Loss of weight will certainly be accomplished if the body loses in water, but to a large extent this loss is the natural consequence of the diminished amount of water contained in the tissues and fluids of the body. If a painful thirst decreases the desire for food, then also the fat may break down as a result of the under-nutrition. But together with a loss of fat a loss of protein is, too, brought about, and this is just what we wish to avoid in all obesity cures.

Treatment by Exercise.—It is known that by muscular work the decomposition of the organism may increase considerably—to double the normal amount and still more. Nevertheless, through sports and athletics the body weight is not always decreased: though the total

metabolism reaches three times the normal, the appetite increases proportionately.

Only when the food supply is inferior to the increased consumption the body fat breaks down, and indeed at the same time an increase of muscle substance may be observed. At all events, any kind of overexertion through sports has to be avoided in combating obesity, and the amount of work which the patient has to do ought to be carefully estimated.

Zuntz and his school have grounded theoretically the influence of muscle work on the metabolism of fat and have in this way discovered theoretically the mechanics of fat reduction. A man weighing 70 kg. consumes in one hour 16 gm. fat if he walks 3.6 km., 30 gm. if he walks 6 km., and almost the same amount if he covers 3 km. on a road with a rise of 10 per cent.

Exercises on Gaertner's ergostat and medical gymnastics may be used in the same way as the terrain cure. It is a surprising fact that massage has almost no influence on the consumption of fat (Stüve and Leber). On the other hand, it may be mentioned that massage is used in the mast cure in order to promote the circulation of patients, who have to lie quietly in bed for weeks and keep up the mobility of the muscles and joints. In regard to the success of the cure, we would better not expect too much from this procedure, however agreeable it may be to the patient.

Hydrotherapeutics.—In former years it was from the cold bath that a considerable increase in the metabolism was expected (Liebermeister). Exact experiments, however, have shown, that an increase of decomposition results only from the involuntary and voluntary movements which protect the body against loss of heat; the cold bath alone has no direct influence on the metabolism. If we succeed in driving the temperature up through a hot bath, the metabolism increases considerably and may reach a higher figure than would be brought about by a fever of the same degree of temperature. This effect lasts somewhat longer than the hot bath itself. Hot-air or light-baths do not influence the metabolism as intensely nor as permanently, while a hot-sand bath has an effect similar to that of the hot-water bath (Winternitz). The loss in weight of 1 kg., to be observed immediately following the sweat, is of course only due to the increased loss of water and is neutralized a few hours later by the retention of the liquids taken up in great quantity. Heubner has observed that a brine bath, of little effect on a healthy person, raises the nitrogen exchange and total metabolism considerably in scrofulous children, so that these patients may lose in weight in spite of an increased supply of food. In any case, hydrotherapy can only be used in aiding the dietetic treatment of obesity.

Treatment with Mineral Water.—For many years watering places have enjoyed great reputation in the treatment of obesity. The hygienic mode of life, the proper regimen, and the lightly cathartic effect of the usual mineral waters all help to lend success to an obesity cure undertaken at such places. Of course, this success can only be lasting, if the patient, after returning to his accustomed domestic life, does not begin anew the old faulty manner of living which brought about the corpulence in the first place. The influence of saline or muriatic waters on the total metabolism is, however, by no means a constant nor considerable one. Dapper and others have made the important observation that the protein metabolism is not changed by the use of these mineral waters, not even in cases where the subalimentation would favor loss of proteins.

Change of Climate.—Experiments have shown that there is no justification for attributing great influence of sea or mountain air on metabolism. Experiments made by Durig and Zuntz have proved that only at elevations which are beyond consideration as a climatic factor does the total metabolism increase strikingly, whereas the protein exchange rests uninfluenced.

Treatment with Thyroid Extract.—Jorke-Davies and Leichtenstern advised the use of thyroid extract in obesity, since it increases decomposition. In some cases, without assignable cause, there was an absence of all weight reduction; in other cases not only the fat, but also the protein stock is attacked, no matter how large the food supply may be in proteins. The latter fact explains amply the small popularity enjoyed by thyroid therapy. Only in selected cases this treatment may be used with caution, and then only for a short time and with an ample supply of albuminous foods.

Technique of Dietetic Cures for Obesity.—In regard to the technique of the dietetic treatment of obesity, we wish to mention a few points which have not been discussed in the chapter on Fatty Degeneration of the Heart. At present one lays less stress on the quality of the different foodstuffs than on their total calorific value. To a certain degree one may cater to the individual taste of the patient. To demonstrate this v. Noorden gave a regimen agreeable to the patient consisting chiefly of milk, bread, and potatoes. He received:

100 gm. lean meat,	about 130 calories
1 liter milk,	about 600 calories
1 liter buttermilk,	about 450 calories
200 gm. potatoes,	about 160 calories
100 gm. black bread,	about 180 calories
100 gm. raw fruit,	about 40 calories
Coffee, as much as desired.	
	about 1560 calories

v. Noorden distinguishes three degrees in his obesity diet:

The first degree covers four-fifths of the daily requirement, the patient receiving, instead of 2500 calories, only 2000; this form of diet can be obtained by removing from the regimen fat, sweets, and larger amounts of alcohol. This cure is very mild and tolerable for the patient. Without suffering any hardships from his abstinence, the patient loses each month from 1 to 2 kg., provided that he takes plentiful exercise to increase his metabolism.

The second degree of the diet cancels two-fifths of the calorie requirement, so that the patient gets only 1400–1500 calories. This mode of diet is suitable for a protracted cure and may be substituted, if desirable, from time to time by the first or third forms of diet. Ample exercise provided, patients lose as much as 3 kg. per month. v. Noorden recommends this diet as especially valuable in the fatty heart and in the anemic form of obesity.

The third degree covers only two-fifths of the normal requirement, the patients receiving from 1000 to 1400 calories; this is similar to the diet forms of Banting-Harvey, Oertel, Ebstein, etc. A larger restriction in the diet is, from the physician's point of view, severely to be condemned, since otherwise large amounts of tissue protein will break down, a fact certainly not indifferent for the health of the patient.

In the following table we give v. Noorden's dietary for the second degree of the treatment:

8:00 A. M.:	80 gm. lean cold meat, 25 gm. white bread, 1 cup tea, 1 tablespoonful milk, No sugar,	205 calories
10:00 A. M.:	1 egg,	85 calories
12:00 M.:	1 cup strong meat broth,	7 calories
1:00 P. M.:	1 small plate meat broth flavored with vegetables, 150 gm. lean meat, 100 gm. potatoes, Salad, vegetables, as cauliflower, asparagus, 10 gm. butter,	583 calories
3:00 P. M.:	1 cup black coffee.	
4:00 P. M.:	200 gm. fresh fruit,	90 calories
6:00 P. M.:	1/4 liter milk, with tea if desired,	97 calories
8:00 P. M.:	125 gm. cold lean meat with pickles or radishes and salad. 30 gm. graham bread. 2 to 3 tablespoonfuls cooked fruit without sugar.	
		1366 calories

The use of mineral waters, weak tea, or lemonade is not limited either at meal time nor in the intervals.

V. Anomalies of Development Caused in Part by Diseases of the Thyroid Gland.

A series of disorders is connected with aplasia, hypoplasia, or degenerative processes of the thyroid gland. This causal relation is to-day proved beyond question through the efficacy of the organotherapy.

1. **Cretinism.**—*Clinical Findings.*—Cretinism is endemic in some mountainous regions and occurs often in the same family. A small goiter is generally present in the first years of life, though it may be absent in the gravest cases (Wagner). The cretinoid expression may be completely developed as early as the third year. The development of the trunk is retarded in its longitudinal growth, still more the extremities, which are thick and short; the skull is broad and low. The skin is pale and thick and the mucous membrane of mouth and tongue may be thickened. The voice is hoarse and in grave cases often grunting. The intelligence suffers very much. Very characteristic is the saddle-nose.

Anatomical Findings.—The thyroid gland often shows a strumous degeneration, and is sometimes replaced by a piece of connective tissue or by a cushion of fat. Very striking is the delayed ossification in the nuclei of the epiphyses (at the present time to be recognized *in vivo* by the X-rays) and their delayed coalescence with the diaphysis. The most important finding, histologically, is the absence of the cartilage cell columns of the epiphyses.

Treatment.—The treatment, in every case, prevents farther advancement and usually a very remarkable improvement is accomplished, but never complete recovery. It consists entirely in feeding with thyroid extract, either fresh or as the dried product. If applied early, the organotherapy has undoubtedly a favorable influence on the longitudinal growth of the bones and on the mental development.

2. **Myxedema.**—An abnormal function of the thyroid gland is also the cause of myxedema, in which a peculiar pasty swelling of the general integument occurs. It is a strictly chronic disease identical in its chief symptoms with cachexia strumipriva, appearing generally between the twentieth and fiftieth years of life, seldom at more advanced age, and extremely rarely in childhood.

Symptomatology.—This disease begins with swelling of the face; the lips and the nose become thick and broad; there is a puffiness around the eyes and on the chin; the tongue becomes swollen and shows the impression of the teeth. Thickening of the extremities, of the hands and feet, fingers and toes, soon follows.

In pronounced cases all normal contours are lost; on the throat, the back of the neck, in the supraclavicular fossæ, and over the

pectoralis major, as well as on the back of the hands and feet, formless spongy pads appear which do not pit on pressure. A pendulous abdomen develops, often an umbilical hernia. The mental functions become gradually defective, so that finally even incontinence through apathy may result. The prognosis, if thyroid extract is given, is a favorable one, otherwise the course of the disease is slow but progressive.

Treatment.—It is well to begin the treatment cautiously and to increase the dose gradually; all symptoms which announce thyroidism, as tachycardia, tachypnea, rheumatic pains, dizziness, headache, vomiting, and sleeplessness must be carefully watched for. One may give the fresh gland of a sheep raw, on bread, beginning with about the eighth part of one gland and gradually increasing until two glands are taken. There are, besides, different tablets on the market, of Parke, Davis & Co., of Burroughs, Wellcome & Co., of Merck, of which 1/2 to 3 may be taken daily. Czerny emphasizes that the unpleasant secondary symptoms, which sometimes are to be observed when dried preparations are given even cautiously, do not occur if the fresh gland is administered, though in large quantities.

3. **Micromelia and Microcephalia.**—Whereas other disturbances of metabolism, as Graves' disease, operative or congenital myxedema, and mongolism, are intimately connected with the function of the thyroid gland, it is certainly not the case in micromelia, a condition due to a congenital chondrodystrophy (hyperplasia of the cartilages of the tubular bones), occurring most commonly in the femur and humerus. In this condition the skin never undergoes myxedematous changes and the intelligence does not suffer. The treatment with thyroid extract is entirely without success.

The disease known as chondrodystrophia or achondroplasia was formerly called fetal rickets.

Microcephalia may be due to an arrested development or to a grave disease of the brain during fetal life (pseudomicrocephalia). General tonic rigidity characterizes the first form; athetosis, bulbar symptoms, and epilepsy the latter. Lannelongue, proceeding from a false conception that a primary process of the bones leads to premature synostosis, proposed trepanning the skull in order to furnish room for the brain. The result, however, failed entirely.

4. **Rachitis.**—A common cause of diminished length of the body and of an absolute as well as a relative shortening of the extremities is rickets; only severe degrees may cause difficulty in distinguishing it from achondroplasia. In rachitis the ossification (very clear in X-ray picture) and dentition are delayed, which is not the case in achondroplasia.

5. **Osteomalacia.**—In osteomalacia, a disease attacking women especially at the time of puberty, one sometimes makes the surprising observation that patients become shorter. O. Vierordt gives three different causes for this phenomenon: First, the os sacrum sinks with the promontory into the pelvis; second, the bodies of the vertebræ become flattened in the lumbar region; and, third, the patient's stoop, an attitude due to the pronounced kyphoscoliosis in long-standing cases.

The same symptom of shortening is found in the senile osteoporosis; in this condition "pure resorption" of the bone takes place without a lime-free substance being formed (O. Vierordt).

The diagnosis of osteomalacia in the early stages, as long as the only complaint is in the lumbar and pelvic regions, is very difficult. It is only when the typical waddling gait develops that confusion with spinal affections and rheumatic complaints can be avoided.

The treatment consists in hygienic-dietetic measures, in hydrotherapeutics, in the administration of calcium phosphates or, better, of cod-liver oil with phosphorus (Kassowitz); pregnancy and, preferably, also sexual intercourse should be avoided. Fehling has recommended the castration of every patient suffering from osteomalacia, whether pregnant or not. Some gynecologists, in performing the Cesarean section in pregnant subjects of osteomalacia, finish with the supravaginal amputation of the uterus and castration.

6. **Acromegaly.**—Acromegaly is a disorder of very chronic course, characterized by a partial hypertrophy of the soft parts and of the bones; the parts chiefly involved are the inferior region of the face and the hands and feet, which may show great deformity. The face with its projecting lower jaw reminds one of the heads of anthropoid apes: the hands become monstrous paws. Beside the thickening of the bones, which may be demonstrated by radioscopy, the hypertrophy of the skin and subcutaneous connective tissue plays an important part. Pierre Marie first called attention to the relation of this ailment to changes in the pituitary body. The treatment of this disease, which leads to chronic invalidism, attempts to meet the causal indication by administering extract of the hypophysis or of the thyroid; beside this, arsenic, potassium iodid, and inunctions of mercury, even though no proofs of syphilis are present, are to be tried; as a palliative treatment, if symptoms of cerebral pressure are present, trepanning may be thought of (Lynn-Thomas). In the last few years attempts have been made to extirpate the pituitary body, which in some cases has brought about a remarkable improvement or restitution (Horsley, Cushing, Schloffer, v. Eiselsberg, Hochenegg).

Other diseases which change the configuration of the whole body or of its parts cannot be discussed here in detail. To this group

belong: true nanism, gigantism, leontiasis ossea, osteitis deformans (Paget's disease), clubbed fingers, etc.

VI. Metabolism in Children

Peculiarities of Metabolism in Infancy.—The metabolism of the child differs in some important respects from that of the adult. These differences are more conspicuous the younger the child is; most pronounced, therefore, in infancy and especially in premature births.

Voit's law of metabolism, that of the food taken in and of its chemical energy nothing is lost, evidently applies also to the infant. The energy in the food absorbed is equal to the sum of the energies of the body substance built up, of the radiated heat, of the heat of water evaporation, and of the muscle work done. If the food supply is not sufficient, body substance breaks down and the same equation holds, but with a negative sign for the deposit of body substance. Then the energy of the body substance lost and of the food taken in is equal to the energy of the radiated heat, of the evaporation of water, and of the movements made. The credit of having extended these ideas to the metabolism of infancy belongs to Camerer and Rubner; the energy which leaves the body through water evaporation and radiation of heat is, for the energy balance of the resting individual, the decisive one. This component amounts to 85 per cent. of the total energy output of the resting adult as well as of the child; in the child where the surface of the body in relation to its weight is as 2 or 3 to 1, the quantity of food required is very markedly influenced by this factor.

Calorie Requirement in Infancy.—Whereas in the adult 35 calories for each kilogram of body weight are supposed to meet the energy requirement, in infants the figure must be placed two to three times higher (W. Camerer).

Heubner expresses himself in the following way: "To accomplish satisfactory development the energy quotient must not be lower than 100 calories in natural feeding and not lower than 120 calories in artificial feeding. But not seldom we see children thriving on a quantity of food which contains much less fuel, especially if the artificial feeding is carried out very exactly. In premature births in which the relatively high loss of heat of infants is still greater, only a food supply of 120 calories for each kilogram body weight will suffice (Langstein). In the third to the sixth month the quantity of energy needed sinks to 90, then to 80 calories."

Overfeeding and Its Sequelæ: Regulation of the Food Quantum.—If the alimentation is forced, the deposition of body substance will be smaller than would be expected from the above equation. This is

owing to the fact that, if the nourishment is too plentiful, the quantity of energy lost through movements increases. This is due not only to the more active peristalsis, the more frequent and larger stool and urine excretions, and the increased secretion of digestive fluids, but chiefly to the augmented muscular action of the child. The properly nourished child spends the greater part of the time quietly sleeping; the overfed infant cries a great deal, and through this crying loses much energy. Czerny and Keller therefore protest rightly against forced alimentation. They proved that a child between the eighteenth and twenty-eighth week of life receiving not quite 70 calories for each kilogram body weight showed an average gain in weight, though others had considered a gain under these circumstances unattainable. Czerny's and Keller's advice, not to give the child more than 1 liter of milk before the end of the first year, is of value, especially for the artificial feeding, in which one of the chief rules consists in avoiding overfeeding. The capacity of the stomach, which served as a guide for the maximum amount of liquid at each feeding, is in the first twelve months of life: 90 c.c., 100, 110, 125, 140, 160, 180, 200, 225, 250, 275, 290. Until three hours have elapsed after feeding we must not count on the stomach's being empty, and therefore no more food must be given.

Caloricity of Infant Food.—As a means of orientation we give in the following the calorific value of the foodstuffs most important for the feeding of infants.

100 gm. of human milk, (cows' milk generally a little less),	70	calories
100 gm. of a mixture of 1/3 milk with a 5 per cent. decoction of oatmeal and addition of milk-sugar, according to Heubner,	40	calories
1/2 milk with the same mixture,	46	calories
2/3 milk with the same mixture,	52.5	calories
100 gm. 1/3 milk with 8 per cent. of Soxhlet's nutrient sugar,	54	calories
1/2 milk with the same,	67	calories
2/3 milk with the same,	78	calories
Entire milk,	60	calories
Buttermilk,	71.4	calories
Soup of Liebig-Keller,	80	calories

Energy Production in Digestion.—The energy of digestion is smallest in breast feeding. For 100 gm. human milk it amounts only to about 10 calories, whereas for cows' milk the double quantity is required. This work done may not be entirely lost, for it may serve for the production of heat if the total quantity of heat required is not otherwise generated.

Concentration of the Milk.—The concentration of the milk deserves our weighty consideration. In the first weeks the milk should be diluted with a double quantity of water. The still greater dilution

practised years ago is not advisable, as in this way too large a quantity of liquid is taken in and the food requirement cannot be covered. Only in intestinal disturbances may we give weaker concentrations, always remembering that this is in fact a starvation treatment. In the fourth month half milk and half water may generally be given; at the fifth month, two-thirds milk, until in the eighth month the child receives whole undiluted milk.

Some authors begin at once after birth with plain milk; in this case the danger of too frequent or too abundant feeding must be very carefully avoided. In any case children with feeble digestion (as premature children and those with innate inclination to digestive disturbances) ought not to receive this form of nutrition.

Means to Improve the State of Nutrition in Atrophic Nurslings.—Monrad advocated a means of improving atrophic infants with the undiluted raw milk of animals; most suitable for this purpose is the milk of goats and asses. Our aim in the nutritive therapy of pedatrophy must be first to remove the digestive disturbance; in this we shall succeed only if we study carefully the quality of the stool; we shall speak of these indications later in the chapter on Examination of the Feces.

Nutrition after the First Year.—Investigation of the food requirement of the child in the period following infancy shows considerable fluctuations at the different ages. The following data are taken from a chapter on "Nutrition of the Child After the First Year of Life," by P. Sommerfeld in Pfaundler and Schlossmann's "Manual of the Diseases of Children."

AGE IN YEARS	PROTEIDS	FAT	CARBOHYDRATES
2–4	40–64 gm.	32–62 gm.	110–205 gm.
5–7	50–58 gm.	30–43 gm.	145–197 gm.
8–10	60–88 gm.	30–70 gm.	220–250 gm.
10–11	68–86 gm.	44–85 gm.	211–270 gm.

In this connection Camerer's law, that two children of different ages but of the same weight have the same food requirement holds. The calorie requirement per kilogram body weight decreases slowly between the second year of age and the time of puberty.

2– 4 years,	75.3 calories	
	MALE	FEMALE
5– 7 years,	76.6 calories	69 calories
7–10 years,	61.6 calories	59.2 calories
11–14 years,	47.3 calories	51.4 calories

According to Steffen, a healthy child should be fed five times a day; the calorific value of the food should be 1200 per day at two years of age; 1525 at three years of age; 2260 calories between four and seven years.

A child two years old should receive daily 1 liter milk, 60 gm. meat, 40 gm. ham, 1 cup of bouillon with 1 egg, 50 gm. vegetables, 35 gm. potatoes and 1 piece of bread with butter. At three years the amount of meat may be increased to 75 gm. and the ham to 50 gm.; 100 gm. vegetables, 50 gm. potato, and a large of bread and butter may be given beside. Between the ages of four and seven years the liter of milk is continued; beside this 100 gm. meat, 50 gm. ham, 150 gm. vegetables, 75 gm. potato, 250 gm. bread, and 30 gm. butter are supplied.

Of course it will often be necessary to make changes in this form of diet, but it will be advisable to follow the rule of Camerer that the relation of the nitrogenous food to the nonnitrogenous shall be 1:4 or 1:5 and that it is desirable to give at least half of the proteid foodstuffs in the form of animal proteid. In this way the quantity of milk, which between the ages of two to four years constitutes nearly half of the albuminous food given, is reduced to such an extent that at the time of puberty scarcely the tenth part of the entire amount of protein food is taken in the form of milk. At this time the nitrogen contained in meat and eggs, on the one hand, in vegetables, especially in the leguminous ones, on the other, is equivalent to nine-tenths of the entire nitrogen introduced. It is desirable that the vegetable and animal proteins counterbalance each other.

If a child of two to four years is to be abundantly fed during convalescence or in the course of an afebrile exhausting disease, the following dietary is advised by Sommerfeld:

1. Breakfast: 1/4 liter milk with 50 gm. bread.

2. Ten o'clock lunch: 50 gm. bread, 10 gm. ham, 10 gm. butter, 1/4 liter milk.

Luncheon: 125 c.c. soup, 50 gm. roast meat.

Four o'clock: 1/4 liter milk, 50 gm. bread.

Supper: 1/4 liter milk, 1 egg, 50 gm. bread.

Calorific value, 1400.

To a child of five to eight years the following rations are given (Sommerfeld):

1. Breakfast: 1/2 liter milk, 100 gm. bread.

2. Ten o'clock lunch: 1/3 liter milk, 50 gm. bread, 15 gm. butter, 30 gm. ham.

Luncheon: 250 c.c. soup, 125 gm. meat, 333 gm. green vegetables.

Four o'clock: 1/3 liter milk, 50 gm. bread.

Supper: 1/4 liter milk, 1 egg, 50 gm. bread, 30 gm. ham.

Calorific value, 2000.

If fever is present, milk bouillon and 1 egg will have to be sufficient; in this way one can scarcely give smaller children more than 800 calories, larger ones more than 1100. If only moderate fever

exists, one may, in accordance with the experience of v. Noorden, give also a small quantity of butter as well as hashed meat, bread, zwieback, and mashed potatoes. Vegetables would better be excluded from the diet in such cases.

VII. Disturbances of Nutrition and Development in Infancy

Dyspeptic Disorders

1. **General Remarks.**—We shall here disregard those disturbances of nutrition which are dependent on infectious diseases localized in the digestive tract, whether due to an invasion of the germs into the mucous membrane or merely to a bacterial decomposition of the contents of the digestive organs; bacteria normally occurring in the digestive tract may occasionally become pathogenic (the endogenous infection of Escherich).

Czerny and Moser in 1894 grouped together the nutritive disturbances of nonbacterial origin as dyspepsia, in opposition to the infectious-toxic group (gastroenteritis.) We should not think only of the processes taking place in the intestine itself; rather we should follow out the fate of the resorbed nourishment and not observe the anomaly of the nutritive state without considering the intermediate metabolic processes.

The cause of dyspeptic disorders may rest on the amount and composition of the food consumed (nutritive disturbances *ex ingestis*), but they may also be due to a congenital motor or secretory insufficiency of the digestive apparatus, as seen especially in debilitated and premature children. We shall first consider the former condition more in detail, adopting the new terminology and division of Czerny and Keller.

2. **Milk Disturbances in Artificial Feeding.**—*Clinical Findings.*—If one nourishes a child with diluted cows' milk of good quality, one may observe that the previous regular increase in weight ceases and indeed that a slight loss takes place. If, now, one increases the amount of nourishment, as seems plausible in order to attain a new increase, one may be disappointed by a still more striking loss of weight. The decrease in weight is not the immediate result of an unwarranted increase of food; it may sometimes follow upon a transient increase of weight, but if it has once become established it does not usually yield to continued random feeding and may lead in severe cases to a fully developed atrophy.

The children even in the first stages are restless, often cry the entire night, and suffer from meteorism. At the same time a marked anemia develops. The stools are grayish-white, dry, and have a purulent odor. The examination of these stools shows a high per-

centage of soaps preponderately of the earthy alkalies, which explains their peculiar color and consistency.

Following the doctrine of Biedert, the casein of cows' milk was considered very indigestible until Escherich and the Breslau School pointed out the small part casein played in the nutritive disturbances of infancy. That which earlier was designated as "casein stool" chemical investigation has shown to be soap; that is, fat-stool. In examination of the stool regard for the general condition must not be neglected. The children are backward in their physical and mental development; they are not merry, do not laugh, are apathetic, and are conspicuous by their quietness. Their muscle tone is very much decreased, recognized especially on palpation of the flaccid abdominal walls. The hypotonus and meteorism of the abdomen sometimes reveal the contours of the intestinal loops.

Prognosis.—In cases which have not progressed too far one may, by the proper nutritive therapy, bring about the result that the decrease in weight at first comes to a standstill and then gives place to a small but constantly increasing rise. The anemia and the pathological condition of the stool improve at the same time. One may only speak of a cure when the child without invalid diet thrives on the normal food-equivalent corresponding to his age (in relation to the quantity and quality).

Treatment.—Since in the nutritive disturbances produced by undecomposed cows' milk the fat has to be considered as the injurious factor, the rational therapy becomes clear. Our chief aim will be to remove the fat, wholly or in part, and to replace it by an appropriate nutritive material. Experience shows that carbohydrates are best adapted to this purpose. In very light cases, however, one succeeds by reducing the total amount of food. The meals are reduced to five and the total quantity is less than that which corresponds to the age of the child.

In severe cases, however, the fat assimilation has suffered to such a degree that the necessary quantity of food is attainable only by addition of carbohydrates. Ordinary or dextrinized flour, cane-sugar, or maltose, not milk-sugar, should be added in the necessary quantities, and buttermilk and malt soup with milk are recommended.

In the first weeks of life the secretion of the sugar-forming ferments is very small. We hesitate to give such young infants flour decoctions, though it has been reported that infants of only a few weeks have thriven well on buttermilk and flour. In general, one will have to resort to mucilaginous decoctions. If sometimes it becomes necessary to use Keller's milk malt soup, Czerny and Keller suggest that this be given for several weeks until after about four to six weeks one gradually returns to milk. It will be safest, in very young infants, to give

them the breast as soon as some disorder due to cow's milk has occurred. In such cases we will generally succeed in saving the life of the child, though an increase of weight may not appear at once on returning to breast feeding; this is readily understood if we consider that the injurious effect of cow's milk is a disturbance of the fat resorption and that woman's milk is a nourishment very rich in fat. The stools are no longer light colored and dry, but slimy, greenish, and sometimes numerous and watery, but with patience one usually accomplishes full success after a few weeks. In severe cases one obtains regular increase only by combining breast feeding with milk malt soup or buttermilk.

The Breslau School explains the favorable effect of the addition of carbohydrates to the food not so much by the action of sugar as a protein economizer and by the changes in the intestinal flora as by the successful neutralization of the acids produced in excess in the intermediate metabolism; this acidosis they consider again as resulting from faulty fat assimilation.

It has not been finally proved that we do not have to deal with a secondary manifestation due to the nutritive disturbance, which with the improvement of the latter disappears also.

3. **Milk Disturbances in Breast-fed Children.**—If we disregard the epidemic and infectious gastroenteritis of breast-fed children and the digestive disturbances conditioned by the insufficient development of the digestive tract and its adnexa, there still remains a class of disturbances which often disturb the welfare of the breast-fed child, though seldom seriously. The chief symptoms are meteorism and colicky pains disappearing after passage of gas; the stools are numerous, sour, slimy, and sometimes, especially in the mucous portions, green. Such children may, however, show a good increase in weight or a sudden rise in the weight curve with small falls.

Overfeeding may almost always be recognized as the cause of these disturbances. There are doubtless cases in which the milk of a certain woman does not agree with a certain child; still this is an exception and the changing of wet-nurses, so much in favor in practice, is in most cases unnecessary. In general, it is sufficient to lengthen the intervals between feedings so that the child has only five feedings in twenty-four hours. If this is not effective, one may limit the duration of nursing to five or ten minutes, and in this way the child will recover after a few days. Sometimes feeding with tea exclusively for one day, eventually combined with 0.005 to 0.03 gm. calomel every two to three hours may become necessary.

4. **Undernutrition of Breast-fed Children.**—In undernourishment the daily increase in weight is too small, and children gain only 10 gm. or less every day and look thin. Their abdomen is flat in

comparison with that of overfed children, at times even below the plane of the thorax. Evacuations are infrequent, small in quantity, dry, and of a dark color. They urinate more seldom and pass a smaller quantity of urine than well-nourished children.

In higher grades of undernutrition these symptoms are more pronounced so that a veritable state of inanition with hunger-stools, dry skin, and sunken fontanels may develop. On taking the breast the small amount of nourishment that the child takes may be seen by the length of time he remains at the breast, without actively nursing, swallowing only occasionally. The weight confirms our suspicions in figures. A knowledge of the fact that undernourished infants do not cry but lie quietly in a lethargic condition is important. Budin has rightly compared them with premature children Gradually they lose the feeling of hunger so that they do not take sufficient nourishment, even when it is offered in abundance.

In such cases it is necessary to resort to nourishment by means of tubes until the want of food and the faculty of nursing has returned. The therapy varies according to the degree of hyponutrition and according to various other circumstances. In severe cases one should search for a wet-nurse with abundant milk and breasts that yield readily; in lighter cases, by placing the child at both breasts regularly every two hours, the secretion may again be stimulated. If the child does not nurse sufficiently and if the procedure involves no danger, after feeding the undernourished child, another strongly sucking infant may be placed at the breast in order to empty them completely; this is the strongest stimulus to secretion. The effect of all the yet known lactagogues is unreliable. If in elder robust infants the mother's milk gives out, one may resort to the double milk feeding (addition of cow's milk), or, if possible, quickly wean them.

5. **Derangements through Farinaceous Food.**—Disorders due to farinaceous food are more rarely observed, since the necessity of nursing children in the first year of life with milk has penetrated deeply into the minds of the people. It is usually an accident which causes the appearance of such a disturbance. Such disorders usually originate in this way, that children fed with milk suffer once from some digestive disorder and either the physician advises a temporary diet of farinaceous food or the mother seizes upon the same idea as a result of the present unfortunate advertisement of children's foods. At first the curative effect on the disturbance caused by the milk is visible, and this circumstance induces the mother to make this dietetic régime permanent.

Two forms of disorders due to floury foods may be differentiated:

(1) The children receive beside milk too great a quantity of carbohydrates, especially of grains. At first they look very well, are

happy, have good color, strong musculature, and a well-developed panniculus adiposus. In spite of this apparently excellent condition, a considerable injury to the organism may have developed; a lowering of the natural immunity which determines the high mortality from intercurrent diseases in such children. In higher grades, even a hypertonus of the musculature occurs, whereby the way is opened to tetany and other diseases of this group. The children become flabby and sometimes edematous.

(2) If children receive flour exclusively, their vitality sinks rapidly and very soon they succumb to infection. The change to milk feeding, to breast feeding, can rarely ever effect a recovery if the nutritive disorders have existed for some time.

When the mother does not add salt to the flour preparation, in a few weeks the influence of absence of chlorids becomes manifest in children nourished without milk. They excrete no salt in the urine and achlorhydria of the gastric juice exists. As a result of the lack of chlorids diuresis increases, and thus there develops a picture which is in direct contrast to the first group with its tendency to edema. They gradually show signs of exsiccation. The true cause of the harmful effects of flour is not yet entirely clear. The poverty in proteins is certainly of importance, still this does not explain all phenomena. The therapy must consist in a copious supply of milk. In such cases human milk is almost essential. For nourishment with any kind of animal's milk includes the danger of bacterial infection on account of the greatly reduced resistance of the organism. Not seldom the attempts to nourish with full milk succeeds, though one risks again the development of milk disturbances; milk with some carbohydrates may be an excellent compromise.

6. **Derangements from Protein Feeding.**—Whether from a milk diet derangements due to proteins may result is not yet determined. Czerny believes that from a too abundant milk supply only fat disturbances are set up, and, in this way, he differs from a number of well-known German pediatricians. The copious foul stools, smelling of alkalies, point to putrefactive processes which may be due to proteids, but not to carbohydrates and fats. Yet these cases may be considered as disturbances of the protein resorption, and it is no binding proof of the contrary, if, in such diseases, buttermilk rich in proteins is of good service. A hyponutrition entirely due to proteins scarcely occurs in infancy. At all times, if, from too high dilution of the milk the proteid requirement is not covered, a general undernutrition will result from the too low calorific value of the food which cannot be increased sufficiently and properly by the addition of milk-sugar or flour.

7. **Nutritive Disturbances through Overheated Milk.**—After the

introduction of milk sterilization at a time when the best success was expected from nourishment entirely free from germs the milk was kept boiling for about an hour. This, however, causes in the milk a far-reaching decomposition which may be recognized by the fact that the milk becomes brownish in color by the change of the milk-sugar into caramel. Möller-Barlow's disease, a form of hemorrhagic diathesis, has been brought into etiological connection with this faulty mode of nutrition. Which of the numerous theories may be the right one concerning the origin of infantile scorbutus, the favorable influence of raw or slightly sterilized or pasteurized milk is certain.

8. **Infectious and Toxic Intestinal Diseases.**—The condition of nutrition suffers very quickly and severely in the acute gastroenterites of various origin; the most dangerous symptom is the loss of fluids. In regard to the therapeutic action the differentiation between the bacterial decomposition of the intestinal contents (chyme infection) and the invasion of the disease producer into the intestinal wall is of the greatest importance (Escherich). In the first case one will find, in the feces, undigested and decomposed remains of food, and perhaps abundant mucus; in the latter leukocytes, epithelial cells, and red blood-corpuscles which are scarcely ever absent. As in severe inflammation, epithelial desquamation, small-celled infiltration, and abscess formation result.

In chyme infections the stomach and intestine are washed out in order to remove, mechanically, the injurious matter, and calomel and castor oil are prescribed internally. All nourishment, even human milk, is discontinued; but, according to Marfan, one must not neglect to give the child the usual quantity of fluids. Later on, one begins with any entirely new food, for instance with a thick decoction of Nestle's or Kufeke's food (one spoonful in twelve to fifteen spoonfuls water for children in the first weeks). By this means one obtains an acid reaction and thereby conditions unfavorable to the growth of the abnormally increased bacterial flora. If the disease preponderates in the lower portion of the large intestine, starch enemas are given. If an intestinal infection has once set in, we are then no longer in a position to check the infection through laxatives or intestinal antiseptics, though in dysentery an improvement may doubtless be effected by cathartics. Here the organism is thrown upon its natural resources, and we can only endeavor, by wise and careful feeding, to strengthen it to the utmost and in profuse diarrhea to maintain its water content through physiological salt infusions, which at the same time afford cleansing and the elimination of the toxins.

In the treatment of dysentery antitoxic sera are recommended.

9. **Digestive Disturbances through Congenital Constitutional Anomalies.**—Premature and debilitated children born at full term very often

suffer in the first weeks of life from digestive disturbances, and the possibility of maintaining life in such children is very materially lessened on this account. Indeed, there are pediatricians who see the chief cause of *debilitas vitæ* in the deficient development of the digestive apparatus.

10. **Genuine Atrophy of Infants.**—We shall now speak of an important chronic nutritive disturbance of infants, the genuine atrophy. By this we understand a disease, appearing usually only in artificially fed children, though it is found in breast-fed children when the latter, in spite of a scanty milk secretion, are left entirely to breast feeding.

We shall disregard here similar anomalies of nutrition accompanying syphilis, tuberculosis, especially of the mesenteric glands (tabes meseraica of the older authors), or following acute diseases of any sort, but chiefly of the digestive tract. In this disease we have to deal with children apparently suitably and sufficiently nourished who are fed artificially and gradually cease to increase in weight, then lose weight and become anemic. The bones of the skull are shoved over one another, especially the occipital and frontal bones under the parietal. The fontanels are sunken, the face is wrinkled like that of an old person, the nasolabial folds are strongly defined, the nose is sharp. Every rib in the body can be counted, the skin lies smooth over the breast, and the musculature of the extremities is entirely flabby and reduced to a minimum. At the same time the amount and quality of the food consumed is generally very satisfactory and the digestion is apparently entirely normal. The children finally die from intercurrent diseases or gradually decline with symptoms of coma from acidosis. The respiration is very deep, comparable to the dyspnea of diabetics *in extremis*.

Prognosis.—The prognosis depends in general upon the development of the atrophic state. Still one often experiences surprises, not only in an unfavorable direction, from complications and unexplainable exacerbations following initial improvement, but also by recoveries in advanced cases under the usually unfavorable conditions in children's hospitals.

Theory.—The opinions of pediatricians differ widely as to the nature of atrophy. Baginsky considers it as "the result of disturbed assimilation from atrophic changes in the intestines." Still other investigators, as Heubner, Finkelstein, Bloch, do not get Baginsky's findings constantly. The atrophic condition of the intestine is said to be simulated by inflation of the intestinal loops and not to be found in the contracted intestine (Heubner). The surprising change for the better at times speaks too for the fact that it is not an irreparable anatomical lesion (Bendix).

Metabolism experiments, at times, but not constantly, have shown

a pure nitrogen absorption (Heubner). Bendix, on the other hand, has always found a considerable disturbance of the fat resorption. In spite of all this we are compelled to accept the view that we have to deal with an abnormal expenditure of energy since atrophic children do not thrive even under conditions most favorable in regard to the calorific value of the food resorbed. With this the final cause of the metabolic disturbance is not explained. The Czerny school sees it in an enterogenous acid intoxication, whereas Pfaundler has made weighty objections to this view and considers the acidosis as a rather insignificant acidification through fat consumption.

Therapy.—Whether the atrophy is a result of chronic digestive disturbances, or whether it has arisen independently of such, the nourishment with mother's milk will always offer the best results. Sometimes it will be advisable to employ the methods usual in acute digestive disturbances (irrigation of the stomach and intestines, calomel, tea diet) or to give for some days only the foods prepared for children. If breast feeding is not at our disposal we may consider:

1. Biedert's cream mixture. Ramogen, Gärtner's fatty milk.	Fat milk.
2. Backhaus milk, Voltmer's milk. Both predigested by trypsin.	Fat milk with predigested proteids.
3. Liebig's soup, Keller's milk malt soup, Holland milk (buttermilk), milk dilutions with Soxhlet's nutrient sugar solutions (containing dextrin).	Preparations rich in carbohydrates.

It is not possible to outline strict indications for the above-mentioned substitutes for mother's milk. In general, in bad fat resorption (soapy stools, fat stools) group three should be considered, while in very young infants Backhaus milk is of very much value.

11. **Congenital Stenosis of the Pylorus.**—Of interest is the congenital stenosis of the pylorus, a condition indeed rare but in typical cases always harmful to the development of the child. At times it leads to death through inanition. Incessant vomiting, constipation, and the failure to increase in weight from the period of birth or shortly after it are the prominent symptoms in this disease; they will be discussed in another place.

Premature and Debilitated Children

Definition.—These two ideas are not to be confused; for not all premature children are debilitated, and many debilitated children are born at full term. In premature births, very much depends on the

cause for the early delivery. If, for instance, on account of a contracted pelvis, a child is born prematurely by a *lege artis* induced labor, it requires most careful nursing in the time remaining for the completion of the normal period of pregnancy, but after this period it behaves as any other normal child. The conditions are the same in spontaneous premature births, so frequent after trauma. To be differentiated from these are the early interruptions of pregnancy resulting from diseases of the mother (acute infections, tuberculosis, alcoholism) as well as those from twin pregnancies.

Children born at term may be greatly debilitated; this is found in old parents, especially in old mothers who have already gone through many pregnancies; farther, in mothers who during pregnancies have been in a bad general condition as a result of severe illness, strain, unsuitable nourishment, and mode of life. Diseases of the placenta (hemorrhages into it or between placenta and uterus as well as white infarcts) greatly disturb the development of the fetus. Also mothers suffering from the nephritis of pregnancy and eclampsia give birth to debilitated children (Pinard, Fehlinger, Winkler).

Diagnosis of Premature Birth and of Debilitas vitæ.—The signs of premature birth are well known. The child is far behind mature children in weight and height, and has besides the following characteristics: The skin is covered with lanugo, the finger-nails do not reach the end of the fingers, the distance between the umbilicus and the symphysis is decreased so that the umbilicus is situated relatively lower than in full-term children. The face is often wrinkled, the nose not prominent, the ear muscles not entirely developed; sometimes one finds a pupillary membrane. In boys cryptorchism often exists.

The diagnosis of *debilitas vitæ* is more difficult when it is not possible to observe the child for a long period. Subnormal weights do not mean much, since children of delicate parents as well as twin children are often not debilitated, even if they have a birth weight under 2500 gm.; others weighing over 2500 gm. cannot be kept alive by the most careful appropriate nursing. Pinard emphasizes that healthy children small at birth have a correspondingly smaller placenta, whereas children who are underdeveloped, as a result of debility, are too small in proportion to their large placentas.

Body Measurements of Premature Children.—According to Potel premature children show the following body weights:

6 1/2 months,	1408 gm.
7 months,	1700 gm.
7 1/2 months,	1900 gm.
8 months,	2150 gm.

In the literature much lower values are reported, especially for the earlier months; thus Hecker gives 658 gm. for the sixth month, and Hahn 965 gm.

HEIGHT OF PREMATURE CHILDREN

	Hecker	*Francois*
6 months,	28–34 cm.	37 cm.
7 months,	35–38 cm.	41.3 cm.
8 months,	39–41 cm.	47 cm.

Prognosis in Premature Children.—It is impossible to make a uniform prognosis for premature children from the length of pregnancy, the weight, or height of the body. One must always know the cause of the premature birth. It has been proved by a series of statistics that it is in the interest of the child as well as of the mother to induce labor in cases of narrow pelves. Also in premature births caused by twin pregnancies, and in others independent of the health of the parents, the rule holds that the first two or three weeks especially is the critical period in the infant's life. Exact investigation as to the cause of the debility in children of unhealthy parents is as yet lacking. Perhaps an insufficient development of the digestive organs has to account for it; in any case dyspeptic disturbances are very frequent. From this point of view predigested milk (Backhaus, etc.), as well as ferment preparations, has been recommended. Bendix names lactopeptin, .15 to .25 gm. and pancreon .25 to .30 gm. to be given at every feeding, or at every second feeding administered in some mother's milk which has been pumped out. Also the addition of pegnin is recommended, not in order to substitute the rennet, but to accomplish the curdling *in vitro*. By shaking, a finely flocculent coagulation is produced.

Somnolence, low subnormal temperature (below 33° C.), superficial breathing, cyanosis and intercurrent diseases without fever are to be considered as unfavorable signs. It is sometimes impossible to differentiate atelectasis of the lung from a pneumonia running its course without fever.

Therapy.—Only in a very few cases do we succeed in keeping infants with a body weight under 1000 gm. alive. The treatment of premature children centers about three indications. First, they must be protected from infections (through the skin, digestive and respiratory tracts); next, they are to be carefully guarded from loss of body heat, and, finally, suitably nourished.

The danger of infection is best combated by nursing at the mother's breast which, as is well known, greatly increases the immunity of the body. By this means an important source of infection, the food, is excluded. The mouth of the child should not be touched, but the

breast of the mother is to be kept clean. The provision for pure air is of greatest value, an indication very difficult to meet on account of the necessity of avoiding loss of heat; the skin should receive careful attention.

Standard Values

(Chiefly from data and tables of H. Vierordt)

In order to judge of the state of nutrition and development in the child we require certain constant figures by which to prove the correctness of our judgment.

Height of Body.—The average size of the people of Austria is 153.3 cm., the female being about 8 to 16 cm. shorter than the male.

The body length of the new-born is about 50 cm.

The development of the body in length in the different years of life is as follows:

Years	*Male*	*Female*
1	69.8 cm.	69.0 cm.
2	79.1 cm.	78.1 cm.
3	86.4 cm.	85.4 cm.
4	92.7 cm.	91.5 cm.
5	98.7 cm.	97.4 cm.
6	104.6 cm.	103.1 cm.
7	110.4 cm.	108.7 cm.
8	116.2 cm.	114.2 cm.
9	121.8 cm.	119.6 cm.
10	127.3 cm.	124.9 cm.
11	132.5 cm.	130.1 cm.
12	137.5 cm.	135.2 cm.
13	142.3 cm.	140.0 cm.
14	146.9 cm.	144.6 cm.
15	151.3 cm.	148.8 cm.
16	155.4 cm.	152.1 cm.
17	159.4 cm.	154.6 cm.
30	168.6 cm.	158.0 cm.
60	167.6 cm.	157.1 cm.
80	163.6 cm.	153.4 cm.

According to d'Espine and Picot (Quetelet) the child grows.

In the first month about	4 cm.
In the second month about	3 cm.
In the third month about	2 cm.
In the following months about	1–1.5 cm.

In the whole first year.	19.8 cm.
In the whole second year	9 cm.
In the whole third year	7.3 cm.
In the whole fourth year	6.4 cm.
In the whole fifth year	6.4 cm.
In the next ten years (each year)	6 cm.

Relative Measurements of the Different Parts of the Body.—According to Topinard the body measurements in adults are, for every 100 cm., as follows:

Length of the head (angle of the lower jaw to the top of head),	13.3 cm.
Length of neck (occiput to spinous process of seventh cervical vertebra),	4.2 cm.
Length of trunk (seventh cervical vertebra to the perineum),	35 cm.
Length of leg (crest of ilium to the sole of the foot),	47.5 cm.
Arm length (shoulder arch to the tip of the middle finger),	45 cm.
Breadth of shoulders (between the arches of the shoulders),	23 cm.
Hip breadth (between the outer parts of the crests of the ilia),	18.8 cm.

Body Weight.—The body weight of man is, on an average, 64 kg., and according to the development of the skeleton, of the musculature, and of the fat cushion, it varies between 42 and 84 kg. The average weight of woman is 52 kg., with variations between 36 and 76 kg. (Krause).

At birth boys generally weigh 3333 gm., girls 3200 gm. (H. Vierordt).

The body weight in the different years of life is as follows (after Quetelet):

	Male	*Female*
New-born	3.1 kg.	3.0 kg.
Until 1 year	9.0 kg.	8.6 kg.
2 years	11.0 kg.	11.0 kg.
3 years	12.5 kg.	12.4 kg.
4 years	14.0 kg.	13.9 kg.
5 years	15.9 kg.	15.3 kg.
6 years	17.8 kg.	16.7 kg.
7 years	19.7 kg.	17.8 kg.
8 years	21.6 kg.	19.0 kg.
9 years	23.5 kg.	21.0 kg.
10 years	25.2 kg.	23.1 kg.
12 years	29.0 kg.	29.0 kg

	Male	*Female*
14 years	37.1 kg.	36.3 kg.
16 years	45.4 kg.	43.5 kg.
18 years	53.9 kg.	49.8 kg.
20 years	59.5 kg.	53.2 kg.
25 years	66.2 kg.	54.8 kg.
30 years	66.1 kg.	55.3 kg.

After the fiftieth year a small decrease in weight takes place.

BODY WEIGHT IN THE FIRST DAYS OF LIFE

Body Weight in the First Week.—The new-born decreases in weight very considerably until the third day, 200 gm. and more, of which as much as two-thirds is lost on the first day and the last one-third on the second day. Then an increase usually sets in, so that the birth weight is again reached on the eighth or the tenth day.

Weight in the First Thirty Months.—Schmid-Monnard's tables show the following figures for the body weight of boys and girls in the first thirty months.

END OF	BOYS	GIRLS
1 month,	3451 gm.	3219 gm.
2 months,	4108 gm.	4002 gm.
3 months,	4840 gm.	4792 gm.
4 months,	5670 gm.	5409 gm.
5 months,	5868 gm.	5866 gm.
6 months,	6802 gm.	6426 gm.
7 months,	7017 gm.	6855 gm.
8 months,	7152 gm.	6936 gm.
9 months,	7579 gm.	7396 gm.
10 months,	8312 gm.	7527 gm.
11 months,	8412 gm.	7588 gm.
12 months,	8588 gm.	7756 gm.
13 months,	8479 gm.	8277 gm.
14 months,	8897 gm.	8350 gm.
15 months,	8825 gm.	8200 gm.
16 months,	9414 gm.	8807 gm.
17 months,	9810 gm.	9164 gm.
18 months,	9650 gm.	9219 gm.
19 months,	9818 gm.	9247 gm.
20 months,	9973 gm.	9087 gm.
21 months,	9911 gm.	9261 gm.
22 months,	10344 gm.	9887 gm.
23 months,	10299 gm.	9700 gm.

END OF	BOYS	GIRLS
24 months,	10106 gm.	10547 gm.
25 months,	10058 gm.	10542 gm.
26 months,	10336 gm.	11133 gm.
27 months,	10508 gm.	11100 gm.
28 months,	10150 gm.	11000 gm.
29 months,	11100 gm.	11150 gm.
30 months,	11407 gm.	10829 gm.

According to W. Camerer the daily increase in breast-fed children is, in the first four weeks, about 30 gm. It sinks gradually to 20 gm. at the end of the twentieth week, and to 10 to 15 at the end of the first year. Artificially fed children are, especially in the first three months, backward in development compared with those fed naturally. The average daily increase is only 22 gm., but they generally balance their deficit in relation to breast-fed children at a later period because their daily increase does not suffer the constant decrease seen in those that are breast fed. The following rule, easy to remember, usually prevails, that the birth weight of the child is doubled at the beginning of the fifth month of life and tripled at the end of the first year.

The Development of the Infant.—In order to control the development of the infant from fixed data we give the following average values collected by Prof. Pfaundler. In the third to the fourth week the lacrimal secretion begins; thereupon the child learns to fix the gaze; the movements of the eye-balls become coordinated; between this time and the seventh week the first laugh is observed. At the end of this period he usually forms consonants. The infant raises the head at one and one-half to two months; he holds it up for a longer period at three to four months; now he follows moving objects with the eyes. At four months he learns to grasp things; at four to six months he reecgnizes his usual environment; at four to seven months he can sit freely; at ten months stand alone; at twelve to fifteen months walk alone. He forms simple words at twelve to fifteen months; sentences at twenty-four months. A child can usually beg at nine months. Wetting of the bed usually ceases in waking hours at ten to twelve months; during sleep at twenty-four months. In the next few years children who are mentally active endeavor to enrich their imaginative life. They ask continual questions about everything (five to eight years) (Pfister).

Deviations from the Values Given.—Striking deviations from these figures do not always signify severe pathological conditions. They demand, however, investigation of the cause, or if this is not possible an examination for the presence of pathological phenomena.

Delayed Walking.—If a child does not learn to raise its head for

a long time, we must think of hydrocephalus; retarded standing and walking as well as delayed dentition is very suspicious of rickets. However, we see well-developed children, without other signs of rickets, who at one year cannot stand and have no teeth. Under these conditions this is of no significance.

Delayed Talking.—The development of speech is sometimes considerably retarded without special cause, so that children of two to three years can scarcely pronounce single words. There are two factors which may bring about this condition in otherwise normal children. On the one hand, among the poorer classes, children sometimes receive too little attention, and no one talks to them. Among the better classes the change of governesses of different nationality and language is apt to retard the faculty of speech. Imbecile children naturally learn to talk much later; still there exists no parallelism between this retardation and weak-mindedness, as very feeble-minded children may learn to talk relatively quickly and those only slightly imbecile very late. In children otherwise normal one may find retarded development only in the region of speech.

Brain processes may lead to aphasia as a focal symptom if the affection lies directly in the region of speech; sometimes these lead to delayed speech development through simultaneous existence of idiocy. Disturbances of speech in childhood have a decidedly favorable prognosis compared with those of later life. In youth there seems to exist the possibility of the development of a speech center in the opposite hemisphere. Central diplegia is very unfavorable; it seldom leads to idiopathic dumbness but to an increased difficulty in learning to speak which can only be overcome by untiring continued practice. Hereditary syphilis, if localized in the central nervous system, may bring about not only a marked diminution in intelligence but also disturbances of speech, difficulty in learning to speak, and even aphasia.

Delayed Continence.—When a child cannot learn to retain the urine until late, one must think of organic changes in the genito-urinary tract (ectopia of the bladder, epispadia, hypospadia, underdevelopment of the sphincters) and of constitutional diseases (diabetes mellitus, insipidus, anemia, weakness, rachitis, etc.). Then we have to consider psychical defects of all kinds, all forms of imbecility, bad habits, defective educational influences, and masturbation.

One must always distinguish whether a child was at first able to retain the urine and has lost the faculty or whether he never had it. In the first case, all transverse interruptions in the spinal cord, neurites, and peripheral nerve affections (irritability of the musculus detrusor) along with the various diseases of the urinary tract have to be thought of. If a child has been continent only for a short time he forgets again

in the course of a severe illness to retain the urine and feces; therefore, in the course of a diphtheria this must not be considered a sign of a beginning postdiphtheric paralysis.

C. ANOMALIES OF TEMPERATURE

Historical Development of the Conception of "Fever"

Since the earliest times the rise of the body temperature which accompanies the most various disease processes has claimed the interest of the physician. The modern revolutions in the conception of this pathologic phenomenon have naturally exerted an influence on the therapy. Thus the question has been discussed for centuries whether the increased body temperature should be considered a beneficial or a harmful process, and weighty arguments have been brought forth by innumerable authors in support of these two conflicting opinions. It seems, therefore, justifiable if, in a discourse on the most important and dangerous symptoms, we make fever the subject of a far-reaching discussion; the more so since it is a symptom which often arouses fear in patients and causes them to seek help from the physician, for it appears to them of special gravity.

First it seems necessary to discuss the peculiar symptom-complex which is usually designated by the word "fever." The original Greek word signifies "fire," and the increased heat was viewed by Hippocrates as the most important manifestation of fever.

At a later period a series of manifestations were added to the conception of fever which occurs simultaneously with the rise in temperature in part as a result of this rise in temperature. According to the idea of Galen, the rise in temperature was considered the essential principle of fever (*Calor praeter naturam*). Later on, before the use of the thermometer, the heightened frequency of the pulse denoted the most important expression of fever. Since the introduction of the thermometer, the heightened temperature has again been considered the essential.

The views on the significance and nature of fever have repeatedly changed until modern times. According to Sydenham, fever was a means of which nature availed herself to separate the pure part of the blood from the impure. In this he approaches the Hippocratic conception that fever is a remedy. Liebermiester, in 1870, defined fever as a symptom-complex depending on an alteration of the heat regulation, the production of heat being increased while the amount of heat lost remained the same, so that an increased body temperature resulted. Pflüger's School also places the chief importance on this point, while Traube sees in fever a stagnation of heat conditioned by a decreased loss of heat through the skin and lungs.

Causes of Fever

Varieties of Fever Depending on the Kind of Infection.—Concerning the cause of fever, it has been proved for many diseases accompanied by an increase of temperature that this is due to an organized infection. This is probably true for many affections in which the proof is lacking as yet. Since the multiplicity of symptoms in the different diseases is for the most part dependent on the variety of toxins which are contained in the microorganisms or which are formed in the body in cooperation with them, it is clear that the entire picture will depend in any special case on the nature of the infecting germ. As causes of abnormal body temperature, we recognize, beside infections, local aseptic inflammations, resorption of gangrenous material, also of extravagated blood (aseptic fever), ferment intoxications, for instance, with fibrin ferment, injections of sera from another species, blood transfusions, hemolysis, hemoglobinemia, as well as lesions of the central nervous system.

Rise in Temperature which is to be Distinguished from Fever.—Within the compass of our discussion belong certain abnormal rises of temperature, which, as already mentioned, appear in otherwise afebrile diseases. These are, first, nervous hyperpyrexia, which appears in acute diseases of all kinds, localized in the pons or in the medulla oblongata. Thus Wernicke ascribes to it the significance of a focal symptom. Next, the high rise of temperature which appears occasionally in apoplectic attacks as well as the not very frequent temperature elevations in progressive paralysis, epilepsy, multiple sclerosis, Basedow's disease, and in other functional nervous diseases.

Hysterical Fever.—The question whether there exists an hysterical fever has not yet been determined, as complications are often difficult to eliminate. We know that even the experienced physician has been led into error, and that by friction on the thermometer heightened temperature has been simulated; we can therefore make the diagnosis of hysterical fever only with the greatest caution when all other sources of fever can be excluded. Rises of temperature without the usual accompanying evidences of fever may be observed in hysterical patients, whereas the other manifestations of fever with entirely normal temperature are seen in other cases (hysterical pseudofever of Pinard and Sarvo).

A. Pick had the opportunity of observing the following case: In an otherwise strong healthy woman in whom, on the most exact examination nothing morbid could be revealed, there appeared a fever in which the temperature rose to 38°–38.5° C. The fever developed in the afternoon and lasted for several hours. The outbreak was accompanied each time by certain compulsory ideas.

The patient, more than ordinarily intelligent, was compelled, as she stated, to think of some word or some sentence. If she endeavored to reduce the body temperature she felt miserable, whereas during the fever she felt better than in the afebrile state and received company without showing any noticeable fatigue. In spite of numerous remedies, this condition continued for perhaps three months and then disappeared entirely without trace. Neither the repeated examinations of the patient by various physicians nor the blood examination gave any evidence as to the cause of the fever, so that it seemed justifiable, considering that compulsory ideas always accompanied the outbreak, to make the diagnosis of hysterical fever.

Immediate Production of Fever (*Thermogenesis*).—As to the genesis of abnormal body temperature in febrile diseases, it is assumed in general that the fever-arousing substance (*pyrotoxin*, pyrogenin) exerts an action on the heat centers. According to Traube, an irritation of the vasomotors is brought about by the pyrogenic substance, as a result of which a contraction occurs in the vessels of the skin, causing a decreased loss of heat. Murri shows, on the other hand, that it is the processes of combustion caused by the pyrogenic substance which leads to an increase of heat.

Liebermeister expresses his opinion concerning the nature of fever in the following words: "The healthy person regulates loss and production of heat in such a way that his temperature remains constant at 37° C.; the fever patient so that his temperature is, for instance, 39°. The economy of heat is the same in the fever patient as in the healthy individual, and all thermic abnormalities in fever may be explained by the alteration of the heat regulation."

According to the kind of fever, the one or the other explanation may be the correct one. In the course of a diphtheria the possibility of a reduction in the oxidation processes has been shown. In such cases we have to deal with a pure stagnation of heat (Arloing and Laulanie).

Babak showed that in febrile and afebrile children of one year, whose heat economy he investigated by means of a respiration calorimeter, the heat regulation during the fever could be disturbed in various ways:

1. The heat production is normal or only slightly decreased while the amount of heat lost is greatly decreased.

2. The production of heat is heightened and the amount of heat lost diminished.

3. The heat production is strongly increased, the loss of heat only to a slight degree.

If the temperature of a healthy person is increased through overheating, a chilly sensation occurs on cooling off when the normal

temperature is again reached and when the cooling is carried still further. The so-called "counterregulation," which is absent in the cooling of the afebrile organism, which has been artificially heated to 39°, takes place at once on cooling the febrile organism which has been similarly treated.

Ughetti, in his work on "Fever," presents the nature of this condition in the following conclusions: "The blood, modified through the pyrogenic cause, irritates the nerve centers which govern the heat regulation. From this a progressive rise of temperature results which, having reached a certain height, may of itself change the function and the finer structure of those centers so that finally they are no longer capable of reacting to the stimulus.

Hemolysis.—In alterations of the red blood-corpuscles a rise of temperature occurs, as in paroxysmal hemoglobinuria. In malaria and in recurrent fever close relations exist between the course of the temperature, on the one side, and the changes of the red blood-corpuscles, on the other. The hyperthermia is probably the result of the action of these factors. Ughetti claims that the immediate cause of fever is the destruction of the red blood-corpuscles, the hemolysis. Still it is more plausible to regard the presence of toxic substances (as the malaria toxin) as the common cause of the hemolysis and of the fever.

Infection.—In infectious diseases the fever generally stands in some relation to the presence of microorganisms, or of their metabolic products, in the blood; it is to be noted that the metabolic products of those bacteria which do not rank as pathogenic may cause elevation in temperature. It seems probable that, while many of the symptoms are of toxic origin, yet the rise in temperature and its immediate sequelæ are not dependent on the presence of toxins. The toxins, in the stricter sense of the word, may exert rather a depressing effect on the nerve centers, thus lessening the irritating effect of the fever-producing substance proper. On the resultants of the two antagonistic components depends the entire picture of fever.

Experimental Research on the Nervous Heat Centers

In spite of numerous experimental works and clinical observations, still nothing conclusive can be stated regarding the influence of the nervous system on the body temperature. Claude Bernard tried to prove the existence of nerves stimulating and inhibiting the production of heat (calorifique, frigorifique); others have ascribed to the lower cervical cord an influence on the heat economy, and others, again, have ascribed this to different regions of the brain.

Thus Aronson and Sachs find one heat center in the striated body and a second one toward the base of the brain. White and Tangl,

too, found heat centers, and Ott has discovered regions in the brain which he considers important for the fall of temperature. The stimulation of the heat centers is supposed to provoke actual fever: not only a rise of temperature, but also the characteristic changes in metabolism.

In Mossos' opinion, thermogenetic regions influencing the temperature in one direction or the other are present in the whole central nervous system.

Symptomatology of Fever

Rise of Temperature.—The rise of temperature often begins suddenly with a chill; often, however, gradually, with a general feeling of illness, lassitude, rheumatic pains and, in many cases, loss of appetite and headache. The shorter the pyrogenetic stage, that is the quicker the temperature rises to a certain point, the more favorable it is for the probable duration of the febrile condition. It means that the fever will cease in a short time, after hours or days, with the same rapidity. In a diagnostic sense the rapid rise speaks against typhoid fever and for malaria, influenza, erysipelas, pneumonia, scarlet fever, measles, small-pox, etc.

With slow onset two chief types of fever occur; an increase of temperature with step-like ascent (typhoid) and one with irregular variations (as in articular rheumatism, pleurisy, pericarditis). The "status febrilis" follows the rise. The temperature curves of this period may be classified in three great groups:

1. The pointed form in malaria, influenza, eruption fevers, etc. This lasts from several hours to a few days.

2. The continued form, with oscillations of perhaps one degree, in which the acme is usually reached in the evening. If the morning temperature is higher than that in the evening one speaks of an inverted type. This occurs in phthisis, if miliary tuberculosis develops, in children and also in people who, by their manner of life, turn night into day (night watchmen). In ileotyphoid there are stationary variations; that is, similar variations each day. Rising oscillations are prognostically unfavorable, descending ones favorable.

3. The form of great variations (amphibolic state).

Under this the exacerbating and remittent types are to be noted. Both occur in ileotyphoid, the first being prognostically very unfavorable, the latter favorable.

The duration of the increased temperature depends on the nature of the disease. In malaria it lasts a few hours, in pneumonia perhaps a week, in typhoid two to three weeks. The fall of temperature may be either rapid, by crisis, as in pneumonia, or gradual, by lysis.

Sudden drops in temperature in diseases without critical defer-

vescence always demand the greatest attention. Especially in the course of typhoid fever a complication, as collapse, intestinal perforation, or intestinal hemorrhage, should be looked for. In pneumonia a sudden fall of temperature does not always mean the beginning of convalescence: it may be a pseudocrisis, after which the progressing defervescence usually follows in a few days, or it may be collapse. The latter is characterized by the crossing of the curves of the sinking temperature and rising pulse, by the malaise, the cold, clammy sweat, the thread-like pulse, and the coldness and cyanosis of the peripheral portions of the body.

The period of fever is followed by the state of convalescence, with slight rises of temperature in the evening or from insignificant causes, such as rich food, constipation lasting a day, physical work, excitement, etc., or by the state of agony, with rising, sinking, or irregular curves.

In regard to the height of the fever, temperatures over 42° C. are to be considered as endangering life. Ughetti gives the following temperatures at which death has followed:

Typhoid,	42°–44° C.	at 42°, still recovery.
Puerperal fever,	43.7° C.	
Scarlet fever,	45.6° C.	at 43.6°–44°, still recovery.
Cerebrospinal meningitis,	43.7° C.	
Small-pox,	44.2° C.	
Pneumonia,	42° C.	
Malaria,	44° C.	at 42°–44°, still recovery.
Pyemia,	42.2° C.	
Facial erysipelas,		at 42° C., still recovery.
Articular rheumatism,		at 43.9° C., still recovery.

Richet relates a remarkable case which, with an axillary temperature of 46° C., still recovered.

With M. Löwit we designate:

Temperatures of 37–38° C. as slightly febrile.
Temperatures of 38–39° C. as febrile.
Temperatures of 39–40° C. as highly febrile.
Temperatures of 40°C. as hyperpyretic.

In certain cases, notably in tubercular meningitis, the temperature still rises in the first hours after death.

Febrile Tachycardia.—The next important symptom of fever is acceleration of the heart action, which is supposed to be the result of the rise of temperature, though as yet we know nothing certain of the connection between the two. In an adult a temperature of

38° to 38.5° C. corresponds to a pulse frequency of 80 to 90 per minute; 39.5° to 40° C., to 110 to 120 per minute; and 40° C. and over, to 120 or more per minute (Ughetti).

A large deviation from these average figures, especially an abnormally high pulse frequency, points to the presence of special conditions or complications. Still certain diseases as scarlet fever have a characteristically high pulse, which therefore need not be of any significance. On the other hand, in icterus, in the initial stage of meningitis, and in typhoid fever bradycardia exists, and if at the same time high fever a relative bradycardia.

In the typhoid fever of children until the time of puberty, as well as in icterus of small children, this bradycardia is not found (lowered tonus of the vagus). The pulse in these cases, especially in abdominal typhoid, is often dicrotic in high fever of short duration, small at the beginning, later hard and full. When the heart is affected, the hardness and fulness decrease.

Febrile Tachypnea.—Respiration, too, is accelerated during high temperature, but not to the same degree as in animals and in experimental dyspnea. As a result of the considerably increased pulse frequency in fever, the relation of respiration to pulse is changed in favor of the latter. While the normal pulse frequency of 72 beats corresponds to a respiration of 18, in fever we find with a pulse of 100 to 120 a respiration of 20 to 25. Any relative figure higher than this justifies a suspicion of a lung affection.

Nervous Phenomena in Fever.—In fever the central nervous system suffers in varying degrees. Whereas in one disease there will be only dizziness, general malaise, and unrest, in others the cerebral symptoms are aggravated to delirium and hallucinations which are followed by, or interchanged with, periods of depression, of apathy, and of sopor. It is probable that these nervous symptoms are not called forth by the rise in temperature, but by the specific infecting material, as we may observe severe manifestations on the part of the brain without any essential increase in temperature.

Metabolism in Fever.—The metabolism is materially altered in fever, and the nutrition is affected perhaps two-thirds as much as in complete abstinence from food, as may be calculated by the loss of weight in febrile patients.

Liebermeister gives the following figures:

	Loss of Weight	
Average daily temperature.	In 5 days.	Per day.
40.6° to 40° C.	3.5 kg.	.7 kg.
40° – 39.3° C.	2.7 kg.	.5 kg.
39° – 38.6° C.	2.1 kg.	.4 kg.
37.9°–38.5° C.	.1 kg.	.02 kg.

This metabolic disturbance is attributed only in part to the increased body temperature.

The Urine in Fever.—The urine which is copious, clear, and of low specific gravity during the state of the initial chill becomes, in the febrile state, scanty, concentrated, of increased specific gravity (1020–1030), cloudy, dark, rich in urobilin, urea, uric acid, and uric acid salts, phosphates, sulphates, and potassium salts, and, on the other hand, poor in chlorin compounds. Its toxicity is greatly increased (Bouchard). The secretory function of all glands is diminished. The skin is dry. The secretion of saliva, of gastric and intestinal juices, bile, and milk is greatly diminished. The red blood-corpuscles progressively decrease in number. The whites behave differently, according to the kind of infection. In the muscles peculiar degenerative processes take place, which are manifested by the disappearance of the transverse striations. These changes are most fatal in the heart muscle where granular fatty degeneration may often be the cause of sudden death.

General Prognosis and Indications for Treatment in Fever

Whether fever is to be considered a threatening symptom or not is a question discussed as much to-day as in former times. Liebermeister expresses himself thus: "A salutary effect of fever on the organism can only be regarded now as an abandoned prejudice of an ignorant time. Fever is a condition which endangers the integrity and often the very existence of the organism, and therefore must be combated by every possible means. With each day the fever lasts its ill effects become more severe."

Ughetti expresses himself in the same manner: "With each day the fever lasts its effect becomes the more severe; the temperature is one of the evidences of this effect."

In recent times, however, the view expressed by Hippocrates again gains ground, that the heightened temperature has a wholesome effect on the course of the infection. The changed vital conditions of the microbes and the action of the protective powers of the organism seem to stand in some causal connection with the heightened temperature. In this regard conflicting results have been reported.

Max Müller did not succeed in decreasing the virulence of typhoid bacilli by cultivation at 40° C. This is equally impossible for other germs. On the other hand, the effect of diphtheria toxin is plainly weakened at 41° C. (Behring, Löwy and Richter). The latter authors could clearly show that fever produced in animals by the brain prick had a favorable effect on different infectious diseases.

In any case the question of the danger of fever cannot be answered absolutely. Height, duration, and form of fever are dependent on the cause of the disease, so that the rise of temperature alone is not to

be considered as the threatening factor. We may meet with temperatures which are much higher than in the most serious febrile disease in many cases involving no danger, such as follicular angina. It may be remarked here that diphtheria usually has a lower temperature than an entirely harmless angina. We see in many infectious diseases that the course is often independent of the height of the temperature. The temperature is of no absolute prognostic value except if considered with regard to the existing ailment. Thus temperatures of 41° to 42° are dangerous in measles and in typhoid fever, less so in scarlet fever, and still less so in recurrent fever. In children the limits of danger are to be placed much higher than in adults. A rapid fall of temperature with a small, weak, quick pulse is a sign of danger; with a full pulse of unchanged frequency, a sign of convalescence. In feverish nephritic patients such a sinking of the temperature, accompanied by oliguria, announces uremia.

Artificial Overheating and Its Dangers.—Experiments have shown that the artificially induced elevation of temperature in and for itself may produce various changes in the organism, most of which are not convincing for our subject, since from animal experiments, where the temperature has been raised from without, one cannot conclude that the conditions are the same as in the febrile state in man (Ughetti).

In febrile patients the temperature hardly ever reaches the height which is fatal to the overheated animal. Fever patients do not die of the changes in the muscles, but of the severe fundamental disease which caused the high temperature (M. Löwit).

Boerhave has shown that a cat, a dog, and a bird will quickly perish in a warm chamber at 75° C.: the cat and dog after half an hour, the bird after seven minutes. He concluded from this that death occurred when the air was so warm that it could no longer cool the blood (quoted from Ughetti).

The experiments of other authors have shown that animals brought into a dry, warm chamber endured high temperatures which proved fatal if the moisture of the air was increased. While in the dry air the body temperature remained much lower than the surrounding temperature, it rose quickly in the warm moist air. This fact is important for tunnel and mining laborers. For though the high temperature cannot be changed, it may be possible to maintain a dry condition of the atmosphere.

At blood temperature over 44° C. a destruction of the leukocytes takes place, and at still higher temperatures destruction of the red blood-corpuscles. In the muscle plasm there are proteid bodies which coagulate at this temperature. It is clear that all of these circumstances must result in death. Labor in rooms above 40° C. must therefore be considered as endangering life.

Taking all these factors together, we may conclude that fever is a threatening symptom only under certain conditions (height, duration), either *per se* or as a sign of a dangerous affection.

Of the other phenomena which usually accompany fever, the changes of the blood, of the musculature, of the nervous system, as well as disturbances of metabolism may be mentioned as possible sources of danger which is to be estimated according to their severity. Foremost among these we find the decrease in the number of the red blood-corpuscles, through destruction, and parenchymatous degeneration of the musculature.

Parenchymatous and Fatty Degeneration.—Whereas formerly this latter change was considered as an effect of the high temperature, at the present time it seems probable that it is called forth by the infecting material (poisoning of the protoplasm). One of the chief causes of death in fever is the parenchymatous or fatty degeneration of the heart muscle.

Danger of Nervous Symptoms.—Lesions of the nervous system may manifest themselves as states of excitement or of depression. It is questionable whether these are due to the height of the temperature or to the infection. The latter, however, is the more probable, since we may observe similar phenomena in the course of diseases without any considerable rise of temperature. Of the two states, the depression is prognostically far more unfavorable than the nervous exaltation which usually precedes it. Of great significance are the metabolic disturbances which accompany abnormally high temperature. These are in part brought about by the disease itself, in part by the loss of appetite, causing a lessened supply of nourishment, and by the disturbed glandular secretions; thus we are not justified in referring the deleterious effects entirely to the rise of temperature.

When Ought Fever to be Combated Therapeutically?—This explains the great difficulty in answering the question whether the fever is to be combated or not, since the possibility is always to be conceded that the heightened temperature may be useful for the body. Ughetti says on this matter: "Since we still find ourselves in the dark on the fundamental questions, we cannot possibly be certain of the conditions which must be present in order to consider the fever beneficial to the organism. But with our present state of knowledge we can admit that the temperature must rise to the height which is necessary for the destruction of the given microorganism and that it lasts as long as is necessary to fulfil this aim.

"If, on the other hand, the fever lasts too short a time, it may not kill all the microbes, and these may produce new attacks; if it lasts too long, the surplus time will cause an injurious effect on the body. This occurs, then, if the temperature is too high or not high enough.

If the organism is too weak to endure the high temperature long, it may succumb before the cause of the fever is destroyed. Here the same thing happens as in many other cases in the compensatory mechanism of the different organs. Fever is a reaction of the organism striving for a useful end, but we must admit that this end may not be reached or that it may be overstepped."

Hydrotherapy.—Since, as a rule, we do not have to regard the height of the temperature as a dangerous symptom, the fight against fever becomes an object of therapeutical measures only under certain conditions; these measures will rather be directed to *combating* the general symptoms accompanying the fever, or, if practicable, to treating the cause. Therefore, we shall give the preference to those methods to which we may ascribe success in this direction, and shall not employ the great number of medicaments which have only an antithermic action and by which the other symptoms are not affected, except probably in an unfavorable manner. Herein lies a great part of the success of hydrotherapy: it decreases the temperature and has at the same time a favorable influence on the other symptoms. We shall find ourselves compelled to combat the temperature, as such, only when it is far higher than we are accustomed to find it in the diseases in question.

Ughetti sees the advantage of hydrotherapy in the fact that it strengthens the reaction of the whole organism against the pathogenic agent which tends to destroy its structure and functions.

Therapy of Fever

Causal Treatment when Possible.—If the diagnosis of the disease, of the cause of the fever has once been made, it is to be combated, causal treatment being the first principle. In the fever of abscess the pus should be drained; in diphtheria and in scarlet fever, dysentery, puerperal fever, epidemic cerebrospinal meningitis, etc., the serum-therapy should be introduced; against malaria quinin and against articular rheumatism salicylate preparations will be indicated.

The fever in tuberculosis may either be of pure tubercular origin or the result of a mixed infection. In the first place, rest in bed is indicated with the fresh-air treatment and hypernutrition. The hetol-therapy (cinnamonic acid) of Landerer, the tuberculin treatment and creosote preparations (thiocol, guaiacol, etc.) may be tried. The fever of the mixed infection is to be treated like septic fever. Landerer recommends for this intravenous injections of *colloid* silver solutions several times a week (0.02–0.04 gm. in 1 per cent. solution). Concerning the medical treatment of fever, we agree entirely with Ughetti. "Though in many benign fevers of short duration, accompanied by

high temperature, it is beneficial to employ an antipyretic in order, for a short time, to allay some of the troublesome symptoms, as headache, restlessness and the like, still one cannot extol the use of antipyretics as a curative treatment in fever. The physician who uses these would not be wiser than the one who at the time when the pulse frequency was considered the most important symptom wished to treat every fever with digitalis. In recent times, however, Jendrassik has again advocated the use of antipyretics and recommends phenacetin by the mouth for children and antipyrin in the form of enemas for adults in severe cases.

Antipyretics.—*Quinin.*—Of the remedies which possess the power of reducing fever quinin stands first. It is a specific against malaria. Its effects may be summarized under the following points (Binz):

1. Given on a fever-free day, it suppresses the further evidences of the malarial toxin.
2. In chronic cases it cures or improves the associated cachexia.
3. It is a prophylactic against intoxication by the malarial toxin.
4. It lowers the temperature in continued fevers, such as typhoid.
5. It limits the daily rise of the body temperature in healthy people.

All this obtains for adults in doses of 0.5 gm. and up. Most striking is the effect of quinin in malaria, and its direct influence on the plasmodium may be observed. Occasionally, even in doses of 1 gm., it causes ringing in the ears, dizziness, and vomiting, and, in very rare cases, even after very small doses, eruptions of the skin. In intermittent fevers it is best given in doses of 1 to 1.5 gm. on the days on which the attack is expected at least six to eight hours before the attack. On the days free from attacks, 0.5 gm. doses are recommended at the same hour. In other feverish conditions 0.5 gm. or more are given at one dose in the evening. When not well borne by the mouth, it may be administered per rectum. For this quinin bisulphate, 1 gm. dissolved in 80 to 100 c.c. water, is especially adapted; before its application a cleansing enema should be given. Quinin is not particularly good for subcutaneous injection, since the injections are painful and easily lead to abscess formation.

Salicylic Acid and its Derivatives.—Of the other fever remedies salicylic acid is to be mentioned as a specific. We employ it usually in the form of the salicylate of sodium, and its preparations possess a specific effect in acute articular rheumatism, because here it not only lowers the temperature, but works favorably on the disease itself. Also inflammations of other serous membranes, as rheumatic pleurisy and pericarditis, are treated more advantageously with this drug than with any other. In large doses salicylic acid causes ringing

in the ears, dizziness, giddiness, and vomiting, and in some people, even in small doses, disorders of the stomach. However, this may be avoided if it is given not as a powder, but dissolved in much water or milk. It is given in doses of 0.5 to 1 gm. several times a day up to 4 gm. in 200 c.c. water. During pregnancy the salicylates are to be used sparingly, since they are said to cause congestion of the uterus (Rabow). Of all the salicylate preparations aspirin in doses of 0.5 to 1 gm. three to five times a day is to be preferred.

Antipyrin.—One of the most effective fever remedies which we possess is antipyrin. In doses of 1 gm. it usually reduces the temperature 1 to 2 degrees in an hour with profuse sweating. After higher doses the temperature may fall even more. Jendrassik recommends for adults the application of 3 gm. antipyrin by the rectum. Though often the other symptoms, especially the nervous symptoms, as delirium, somnolence, and headache improve simultaneously with the defervescence, in other cases the effect is restricted to the temperature. At the same time arrhythmia, vomiting, and chilly sensations are observed as unpleasant consequences. In abdominal typhoid and influenza a favorable effect is ascribed to it, but it is worthless in malaria. In articular rheumatism it influences the temperature favorably and the pain in the joints without materially influencing the duration of the disease. It is given in typhoid, pneumonia, pleurisy, cerebrospinal meningitis, influenza, tuberculosis, etc., in doses of 0.5 gm. three to four times a day in two-hour intervals.

A series of medicaments which belong to the aromatic series, chinolin, tallin, kairin, which were recommended by many as antipyretics, are, however effective, no longer used on account of their unpleasant secondary effects. The reduction in temperature often is accompanied by chills and cyanosis, sometimes with profuse sweating.

Antifebrin.—A remedy, which, on account of its dangerous secondary effects, is at present only rarely employed and which demands special care in using, is antifebrin (acetanilid). Its action begins on doses of 0.25 gm., and may last from three to ten hours. Often the decline of temperature is accompanied by collapse and the following increase by a severe chill. At times the use of this drug produces manifestations of anilin poisoning, recognized by the severe cyanosis, collapse, and bluish-yellow color of the face. This is, however, no true cyanosis, but a dark discoloration of the blood through formation of methemoglobin from the red blood-corpuscles. It is given in doses of 0.25 gm. two to three times a day. Considering the large number of antipyretics at our disposal, it is advisable to avoid the use of antifebrin entirely.

Phenacetin.—Less unpleasant consequences are evoked by phen-

acetin, otherwise its effect is similar to that of antipyrin and antifebrin; 0.3–0.5 gm. is the average dose.

Salipyrin.—Lately salipyrin has become a valuable addition to these medicaments. It affects the temperature less than antipyrin, and in this regard it is to be placed on the same level as sodium salicylate. It causes less disarrangement of the stomach, and has an especially favorable action in influenza. It is given in doses of 0.5 gm. six times or of 1 gm. three times a day. In many cases it works not only antithermically, but also as a sedative and hypnotic, and may be of more service in arthritic fevers and in serous inflammations than any other salicylate preparation. Also in feverish bone processes it acts as a sedative. In pleuropneumonia it may relieve the high fever as well as the pain on respiration. Salophen and zitrophen have a similar action. Pyramidon in doses of 0.3 to 0.5 gm. possesses along with its antipyretic action an analgesic action.

Hydrotherapy.—Preferable to the prescription of all these drugs is the cold-water treatment of fever, because not only the temperature is reduced in this way, but the other phenomena, as sleeplessness, delirium, stupor, heart failure, etc., are effectively combated. Reduction of temperature may be brought about by partial baths, cold baths, gradually cooled baths, by wet packs, cold sponging, and by cold showers. The mildest form of the cold-water treatment, and therefore the best adapted to test the reaction of the organism, is the partial sponging. This is also of prognostic importance, since a defective dilatation of the superficial vessels points to the danger of collapse and contraindicates the use of cold baths.

Partial baths have been employed for years in cases of pneumonia by A. Pick with good results.

"Of its effectiveness he was convinced in the treatment of very severe cases, especially in those where, as a result of the extensive infiltration, symptoms of a high grade of dyspnea were present; also in cases with a high degree of cardiac weakness in which the bath treatment appeared dangerous on account of the necessary exertion connected with it. It is given in the following manner: The patient lies stripped, covered to the neck with a blanket. Then the part to be rubbed is bared, covered with a towel, which has been dipped in cold water and wrung out, and rubbed until the linen becomes warm. This is removed and replaced by another wet towel, and the procedure carried out as before, and repeated three or four times, according to the desired effect. The part is then wrapped in a dry towel, rubbed dry, and covered with a blanket, whereupon one proceeds with the rubbing at another part, first the upper, then the lower extremities separately, then the breast and abdomen together, and finally the back. For this last procedure one may set the patient up or,

where it is not advisable, let him lie on his side. A rubbing off with cold water (from the tap with an average temperature of 9° C.), repeated four times on each part of the body, corresponds in its effect on temperature, pulse, and vessel tonus to a bath of eight minutes' duration at 30° to 27.5° C. The effect may be heightened or lowered according to the temperature of the water used, as well as by increasing or decreasing the number of wet rubs. Partial rubbing is done several times a day—in the morning, in the afternoon, and at night. Most patients find it pleasant and refreshing and often beg for its repetition. The room in which it is carried out should be well warmed, the patient remaining covered except for the part under treatment. In the meantime, in case of bad pulse, one applies a crossed bandage or a fomentation containing a heat regulator to the precordium. In headache or delirium, cold applications or a cooling apparatus is placed on the head."

If, with Liebermeister, one takes as unit of antipyretic action the effect of the cold shower on the body temperature, one may designate the effect of the wet pack as two, that of the gradually cooled bath as three, and that of the cold bath as four. By cold baths we understand those from 15° to 18° C. They were recommended by Jürgensen and Brand in the treatment of typhoid fever. Before any hydriatic procedure is begun the patient is rubbed with a wet cloth on the head, face, neck, and breast; he then receives a cold compress on the head, which must be changed constantly, as congestion of the head can be prevented only in this way.

The patient receives a glass of wine or of cognac or an eggnog, and is then put to bed for perhaps ten minutes. During the bath the skin must be vigorously rubbed. If there is a suspicion of typhoid fever, rubbing the abdomen is, of course, to be omitted. After the bath the patient is wrapped in a sheet, put to bed, and covered without being dried. A hot-water bag or woolen covering is placed on the feet. If the patient is in a soporific condition a shower is given together with the bath. The reduction of temperature begins after the bath and increases steadily for about two hours. Hereupon a new rise of temperature usually follows which loses its intensity after several baths. With the decrease of temperature one observes a lessening in the pulse frequency and a deepening and slowing of respiration. The tendency to hypostasis is most effectively combated by the water treatment, especially if one combines with the baths cold douches on the neck, which stimulate deep inspiration.

Ziemssen, in 1866, recommended in the treatment of typhoid fever baths which were gradually cooled off in the following way: The initial temperature of the bath was 5° to 6° C. below the body temperature, thus with a temperature of 40° to 41° C. about 35° C.,

and was lowered by the gradual addition of cold water to 20° to 18° C. within a quarter of an hour, during which time the patient was vigorously rubbed by two nurses. The patient then remained in the bath until, in spite of the friction, he had a chilly sensation (perhaps fifteen minutes). The first chill is the effect of the cold water and is of no significance. Experience teaches that the first bath has a less lasting effect than the later ones, so that in the beginning of the fever treatment more and colder baths are employed than later on (seldom more than five in a day). Though the effect is less intense than that of the cold bath, still this method possesses the advantage of being applicable in cases of great prostration, in heart weakness, in old age, and in arteriosclerosis.

An excellent form of bath which lowers the temperature and at the same times prevents collapse is the half-bath. A cold compress is first placed on the head to prevent passive congestion; then with a small pitcher water is poured over the neck, back, and breast for one to one and one-half minutes; the body is rubbed vigorously and cold water is allowed to flow on until the temperature has sunk about 2 degrees, the nurse attending to the uniform mixture of the water with one hand and continually rubbing the body with the other. The whole procedure lasts from four to six minutes; it is really a friction bath. It is contraindicated in a high grade of weakness and on tendency to hemorrhage. If collapse occurs in the bath, the patient is not to be taken out, but should be rubbed hard and receive repeated douches on the neck. As a rule, one begins the bath with 32° to 30° C., later on with 28° to 25° C. By this procedure the temperature is reduced about 1 to 1 1/2 degrees. It may be kept down after the bath if one changes a compress on the body every hour. The activity of the heart may be regulated by the application of a cooling apparatus every day for one hour. Together with another on the neck, it produces considerable slowing and strengthening of the heart action.

Thevenot and Moreau, by the use of a spiral tube encircling the abdomen, have attained an admirable regulation of heat in children of one to two years by conducting either hot or cold water through it.

In great weakness or when external conditions make the use of baths impossible, we employ the wet packs, introduced by Winternitz. A sheet 2 meters long, wrung out in cold water, is laid on a woolen blanket 3 meters long. The patient is then placed on this sheet, receiving a compress on the head, which must be changed every five minutes. The hands are placed on the body, the wet cloth wound round it and fastened at the neck, and a dry blanket is placed over it. The effect may be heightened if the patient is packed in two to three sheets at once or if a new pack is given every ten minutes.

One may repeat this two or three times an hour. The effect is a reduction of the temperature and at the same time a slowing and strengthening of the heart. Compresses on the body, made by folding together a sheet four times, leaving the extremities free, serve the same purpose, though not so promptly. After the pack or compress, rubbing is desirable. This is best accomplished by having two bath assistants, one of whom rubs the upper portion of the body while the other rubs the extremities.

In regard to the bath treatment in typhoid fever, Brand, Naunyn, Ziemssen, and Winternitz advise not to begin it later than the fourth day, otherwise it does not have much influence on the course of the disease. The bath has been recommended during the period of remission in order to prolong it, and in this manner give the heart time to recover itself. If the patients react badly, Mathes recommends the application of luke-warm baths for twenty minutes.

In scarlet fever, the partial washing and half-bath are recommended two to three times a day: for adults, at 30° to 26° C., for six to eight minutes; for children, at 32° C., four to five minutes.

Leichtenstern has called attention to the fact that there is at first a slowing of the pulse and later a reduction of temperature. The danger of nephritis is not increased, for Schill, in Wiesbaden, noticed a nephritis only in one out of 110 cases treated in this way. With severe myocardial complications, rest and support of the heart are most important. In these cases the use of the baths is best omitted, especially if children become excited in them.

In measles, complicated with affections of the respiratory organs body compresses are indicated; eventually friction, and with severe cerebral symptoms half-baths of 30° to 25° C., for five to six minutes. Jürgensen had his own child of nine months bathed at 16° C. and later even at 5° or 6° C. without harm. In variola half-baths, wet packs, and the application of the cooling apparatus to the heart will be useful. In diphtheria a suppression of temperature is generally not necessary, but a strengthening of the heart is; the half-baths are adapted to the purpose. Sometimes one may guard against collapse by the use of hot compresses or hot packs every three hours.

In Asiatic cholera hot baths are recommended in the stadium algidum. Winternitz, on the other hand, considers powerful cold stimulation more effective. In bronchitis, half-baths at 33° to 35° C. with cold showers are of great advantage.

In malaria one can effectively combat the attacks by applying over the spleen a powerful cold douche one to two hours before the expected attack; Fleury has noticed a shrinking of the spleen by this method. Partial irrigation of the stomach as well as wet packs have a very favorable effect in pulmonary tuberculosis. Brehmer

and Winternitz have employed the shower-bath and fan douche to good advantage.

Reduction of temperature can also be brought about by the application of a cooling apparatus in which there is a continual passage of cold water in a tube lying on the body. The apparatus is rather expensive, the method offers no special advantages, and its application, at least in adults, is not recommended. Cold bathing, spraying, and local cold applications decrease the temperature only slightly.

In considering the measures which the physician has as first aid in fever, we must keep in mind, first, that generally there is no danger in the rise of temperature, and, secondly, that high temperatures of short duration are not to be considered dangerous. If it is not possible to make a diagnosis at once, the use of antipyretics is not indicated, as they alter the course of the fever and obscure the diagnosis. If the diagnosis can be made at once, the therapeutic action will depend on it and the increase of temperature will not claim our first consideration. As already mentioned, we shall have to judge whether the fever is high or not from the diagnosis of the disease and direct our treatment accordingly. The choice of our remedy will also depend on the disease in question. In typhoid we should give the preference to the water treatment whenever the temperature exceeds 39.5° C. If this is not practicable, among the medicaments, quinin, antipyrin, pyramidon, etc., are to be considered. In pneumonia, pleurisy, influenza, and acute articular rheumatism the preference is given to sodium salicylate and salipyrin, and in cases of weak heart to quinin.

If, as is so often the case in children, the cause of fever is found to be the eating of spoiled food, washing out the stomach and intestines, combined with the use of laxatives, has to be considered, since the whole of the small intestine can only be cleansed by these means. Karlsbad salts, castor oil, and calomel are then indicated, and all food except tea must be withheld in order to remove the medium for the processes of decomposition. Intestinal disinfection is of much service here (menthol, resorcin, orphol). In septic fever, Credé (*Archiv. f. klin. Chirurgie*, 1897) recommends inunctions with colloid silver (unguentum Credé) in doses of 3 gm. per day; colloid silver may also be given in other forms with good success (subcutaneously, by the mouth, by the rectum). One injects 0.08 to 0.12 g. collargol intravenously, thus 2 to 10, usually 4 to 6 c.c., of a 2 per cent. solution.

Löbl recommends collargol, 1:100, for eight to fourteen days in sepsis and in acute articular rheumatism, half to be given in the morning and half in the evening per rectum after a previous flushing. Buberl, from Chrobak's clinic, reports the success of the collargol treatment, which was used as inunctions, by rectum, and in intravenous injections. In one-third of the cases a favorable influence

on the general condition, temperature, pulse, and the resorption of perimetritic exudate could be observed. Wernitz, in Odessa, makes an important suggestion in the treatment of acute sepsis. He seeks to attain a thorough cleansing of the organism by means of methodical irrigation with a 1 per cent. salt solution. Each irrigation lasts for about an hour and may be repeated perhaps six times in the day without annoyance to the patient. The result is that the mucous membranes become moist; the skin loses its dryness; the secretion of the urine and of the sweat increase, and may even become abundant.

Fever in Childhood.—The treatment of feverish conditions in childhood requires special consideration. We must bear in mind that as far as temperature, frequency of heart action, and respiration are concerned, the temperature in children is far more labile than later on and that pulse and respiration have much higher normal counts than in adults.

In judging of a child's pulse the excitement due to the examination plays a large part. Crying of the little patient renders any judgment impossible. One is safest in giving value only to those counts obtained during sleep. The new-born have a pulse of 120 to 140, with a respiration of 40. These figures approach those of adults, at first quickly and later on more slowly.

At the sixth year a child generally has a pulse of 90 and a respiration of 30. The great deviations in morbid changes correspond with these high normal figures, as has been mentioned, in regard to the behavior of the temperature. Temperatures above 40° C. are of daily occurrence in constipation, disappearing on the next day after the successful effect of a laxative. Uncomplicated measles may have a temperature above 41° C. without the case being considered a severe one. The tachycardia in scarlet fever is well known, even on absence of heart weakness, and pulse counts of 120 to 140 are not uncommon.

In febrile conditions of the respiratory tract in children a very high respiration frequency appears earlier than in adults, and is therefore of less significance. Thus a respiration of 60 in the croupous pneumonia of children is not as grave a symptom as in adults.

Only in one regard is fever in children apt to become unpleasant early. The nervous system is very excitable and reacts to high temperatures with somnolence and sopor or with unrest, jactitations, and often with stormy delirium, and even convulsions.

A rapid rise in temperature, which in adults is often associated with chills, in children is frequently followed by general convulsions resulting from the greater excitability of their spastic centers. This condition is often the cause of great diagnostic difficulty, but it often

passes leaving no trace behind, unless the general febrile condition which began with these symptoms becomes localized in the central nervous system (poliencephalitis, poliomyelitis anterior acuta).

The treatment must correspond to the peculiarities of the child's organism. The child's body has a much greater surface in relation to its volume than that of adults. It is enough to remember the axiom that the volume increases as the cube, the area as the square, in order to understand this relation which empirically has been studied very carefully. This pointed out the way for our antipyretic action to withdraw the heat from the surface of the body.

Practical experience corresponds to this theoretical consideration, that cold water procedures should be very effective in treating rises of temperature in children. There have to be considered:

1. Compresses on the trunk for ten minutes to half an hour repeated two or three times, temperature 12 to 16° C.

2. Partial bathing.

3. Bath of 25° to 30° C., varied according to the strength of the patient.

In any case friction during the bath is indicated, in order to facilitate vasomotor dilatation, since the resistance which the exhausted heart has to overcome is thereby lessened and the loss of heat is greatly increased by the widened current of the blood. Alcohol given half an hour before the bath acts in the same way, or a teaspoonful to a liqueur glass of heavy wine, according to the age. In severe febrile conditions and in those with low cardiac power the first bath should be given only in the presence of the physician; a camphor injection should be at hand, since often an unforeseen collapse occurs. An acute exanthem is no contraindication for baths. The effect of the baths may be heightened and modified by cooling it off and by cold spraying. The cold spraying has an excellent effect on nervous symptoms and in threatening hypostasis of the lung. A cold shower on the neck excites deep inspiration and contributes to the airing of collapsed portions of lung. The physical antipyretic treatment may be further set in action in two ways:

1. By cold drinks. The high specific heat of water, which after being taken in is warmed to the temperature of the body, certainly plays a part in the regulation of heat. In the feverish conditions of infancy one may give mother's milk which has been pumped out and carefully cooled in a sterile vessel; the infants take the nourishment in this way often much more readily than the warm milk from the breast. In large children one may give cold lemonade, fruit juices, and ice-cold boiled milk. Above all, one must provide a sufficient quantity of fluid to stimulate diuresis and save the kidneys by the dilution of the toxins. This cleansing therapy works at the same

time antipyretically, since the water passing through the body is warmed to the internal temperature of the body.

2. Riether ("Therapy in Infancy") recommends enemas for the same purpose. After a cleansing enema 50 c.c. water at 12° to 15° C. are allowed to flow into the rectum and remain for five minutes, the anus being closed manually.

The medical antipyretic treatment deserves very limited application since the fall in temperature easily leads to collapse. Sodium salicylate, 1 to 2 gm. to 100, as well as salipyrin 0.5 to 1 gm. to 100, one dessertspoonful every hour, as well as the decoction of quinin, 3 gm. to 100, and quinin hydrochlorate, 0.5 to 2 gm. to 100, may be given without hesitation. Of aspirin and antipyrin as many centigrams are to be given as a child has months, two to three times a day. For quinin sulphate and hydrochlorate Seifert gives the following table in his book of prescriptions for the diseases of children:

0– 1 year,	0.1 –0.7 gm.
1– 2 years,	0.4 –0.8 gm.
2– 6 years,	0.5 –1 gm.
6–10 years,	0.6 –1.25 gm.
10–14 years,	0.75–1.5 gm.

Euchinin, which must be given in somewhat greater doses than quinin, is worth recommending as it does not have a bitter taste. We consider antifebrin and phenacetin as unnecessary antipyretics for children, though Jendrassik has recommended the latter especially for children.

Nutritive Treatment of Fever.—*Metabolism in Fever.*—In the above we have had in mind mainly the danger from acute feverish conditions with high temperature; however, the danger which arises in the long course of a chronic hectic fever is not to be lightly estimated. This condition may lead to a high degree of enervation and emaciation without the temperature's being especially high or continuous. There are, above all, two diseases which show this type of fever, chronic tuberculosis and chronic septicemia. It is possible to understand this condition only from a knowledge of the anomalies of metabolism in fever. We must keep in mind that 60 to 70 gm. of proteid are in every case necessary for the adult and cannot be replaced by other fuel, and that the average healthy working individual decomposes 1.5 gm. protein per kilogram body weight.

The decomposition of proteid is considerably heightened in fever, especially in the beginning, but sinks gradually in long-continued fever. In this first period of proteid decomposition much muscle and gland substance are melted away. The loss in proteid is the

immediate result of the protoplasm intoxication and is never to be avoided entirely by our antipyretic measures. The catabolism of the protein molecule in fever is also qualitatively different, as is shown by the presence of deuteroalbumin in the urine of febrile persons (Krehl and Matthes). The total metabolism is increased if we consider that the patient is resting in bed, but it never reaches the figures of the working individual.

The loss of fat, often very considerable, depends not only on the specific nature of the fever, but is for the most part the result of undernutrition of febrile anorexia.

On longer duration of fever both the absolute and the relative (that is, per kilogram body weight) calorie requirement decline. v. Noorden once determined the minimum requirement in a case of chronic sepsis as 1000 calories per day, which means 25 calories per kilogram—certainly very low. He found similar values in typhoid fever and sometimes in tuberculosis. Therein lies the explanation that persons with "chronic fever at first suffer great losses in body weight; but later, in spite of surprisingly small amounts of nourishment, they maintain themselves weeks and months at an almost constant weight" (F. Kraus).

v. Noorden considers the melting away of the body substance produced by inanition reparable for the most part, whereas we are rather powerless against destruction of the protoplasm. He comes, therefore, on theoretical grounds, to the same conclusion, for whose recognition Graves, in the year 1843, strove, when he laid the greatest stress on the nutrition and on the maintaining of strength in febrile patients, in contrast to the starvation diet in use at that time. The value of nourishment in fever also did not escape the clinical eye of a Trousseau.

Though a rich nourishment is desirable in fever, we must not disregard the disturbances present in the digestive tract if we do not wish to cause harm through forced nourishment or the unsuitable choice of foods. A febrile infection of the digestive canal must first be excluded, since in this case the indication "*primum non nocere*" must be superior to that of nourishment. Typhoid, dysentery, febrile catarrh of the intestine, and cholera-typhoid demand special consideration. Every fever, irrespective of its origin, leads to a decrease in the salivary secretion, in the ptyalin action, in peristalsis, and in the secretion of bile. Generally the hydrochloric acid secretion and the appetite are very small, whereas pepsin is always present in large quantities and the motor function of the stomach is usually good.

In chronic fever the organism accustoms itself to the injurious effects, and thus we often find an excellent secretion of hydrochloric acid and good appetite in chronic tubercular fever. The assimilation

in typhoid fever is very good (v. Hösslin), milk being especially well absorbed (Tschernoff).

v. Noorden found a mixed diet consisting of milk, eggs, zwieback, butter, and scraped beef well assimilated in a pneumonia patient; a phthisical patient assimilated it during the fever caused by injections of tuberculin as well as in the afebrile period.

v. Noorden claims that in every fever continuing for more than a week we must see to it that at least two-thirds of the calorific requirement is covered. In acute feverish conditions one may give 20 to 25 calories per day per kilogram body weight; in chronic fevers, on the other hand, easily 30 to 35 calories. These values relate to the working cell material, not to the adipose tissue, therefore fat people need perhaps a quarter less.

But little is known as yet concerning the qualitative changes of metabolism in fever. The consumption of the glycogen of the organs is well established. May considers it possible to limit the increased protein decomposition by giving carbohydrates. He explains this protein decomposition by the lack of carbohydrates, and not by the intoxication of the protoplasm. Very obscure still is the appearance of febrile acidosis, the increase of ammonia, and the presence of acetone bodies in the urine, as observed especially in the febrile conditions of children.

The calorie balance gives us only the end result, but no conclusions as to the processes of the intermediate metabolism, the splitting, and syntheses which certainly, too, require energy, nor as to the formation of abnormal metabolic products (Richter, "Deutsche Klinik").

We are not yet in a position, on the ground of exact investigation, to give the preference to any particular form of diet. The calorific requirement of a child may be estimated from the following considerations. In rest, the surface of the body is the determining factor in the amount of heat lost, and therefore for the energy required (law of surface development, Rubner). A child, therefore, will have a relatively greater need of fuel than an adult, a thin person more than a fat one. If one calculates the calorific values for the same surfaces, the differences, for the most part disappear.

The full requirement for the breast-fed infant is 85 to 51 calories per kilogram body weight; it is still more for the artificially fed. The relative calorie requirement sinks, then, from birth until the end of the first year. We give febrile children in the first year only milk, unless he have to deal with an enterogenous fever; in this case milk is not indicated. This happens much oftener with cows' milk than in breast feeding.

Technique of Febrile Nutrition.—We shall now speak of the practical methods of nourishing fever patients. Coarse food given in

acute febrile conditions sometimes increases the fever, an observation which we can confirm from our own experience. Milk is the ideal food of acute fever. An adult can consume 3 liters a day with the addition of cream, cocoa, a little coffee, cognac, or sugar. Next to be considered are soft eggs, bouillon, thick soup, wine, wine soup, jellies, etc. Finally, in protracted cases, scraped meat, milk puddings, purées (apple sauce).

Alcohol is certainly adapted to lessen the fat combustion, for 1 gm. alcohol develops 7 calories, and it is very readily combustible and may be thrown as a prey to the fever. It has another peculiarity, that of slowing oxidation processes. Whether alcohol is also a protein economizer is still an unsettled question. It may be prescribed moderately in chronic fever, not *ad libitum*, but, like every other medicament, with a maximum dose per day for each individual. Richter shows that in fevers of short duration the action of alcohol injurious to protein is small relative to its advantages in other lines, and that in fevers of long duration, for instance in the course of a chronic phthisis, it may act directly as a protein economizer. Phthisiotherapeutists, like Dettweiler, have made use of alcohol in the dietetic treatment of tuberculosis.

v. Leyden expresses himself thus: "Alcoholic drinks are almost indispensable in acute febrile diseases." It may be remarked, however, that in severe febrile conditions the intoxicating effects of alcohol cannot manifest themselves, owing to the low state of the nervous system. Thus is explained the erroneous view that in high fever one cannot become intoxicated by alcohol. Maximal doses cannot be determined in general on account of the varied habituation of patients to alcohol, but they must be determined according to the patients' previous manner of life. A person who is unaccustomed to alcohol need not use it against his will, however; children especially do not need it in long severe febrile diseases, as the observations of Kassowitz show.

We have learned from the opponents of alcohol among the physicians that even the most exhausting febrile conditions can be very well treated without it. Thus John Hay, in 150 cases of pneumonia, treated forty-seven without alcohol, and is said to have obtained better results in this way. As excitants black coffee and tea may be used, sugar solutions also improve the heart action considerably; among medicaments caffein and its easily soluble double compounds may be recommended. The so-called food preparations are often overestimated, still one may *occasionally* make use of sanatogen, sanose, plasmon, nutrose, enkasin, somatose, etc.

Beside milk, butter, eggs, and predigested carbohydrates may be used, the latter, however, with special consideration of the lowered action of the salivary and pancreatic ferments.

Leyden and Klemperer recommended giving only small amounts of nourishment, on account of the frequently existing motor weakness of the stomach, in order to render the work of digestion possible. At the same time the nourishment is to be as sterile as possible and good care shall be taken of the mouth, for in case of an existing stasis of the chyme, it may become infected and lead to severe disorders. Proper nourishment in chronic fever is the condition *sine qua non* of its treatment.

The dietetic treatment is often very easily accomplished, but under certain circumstances it becomes very difficult.

It was proved by Maragliano that even fever-free consumptives have a decomposition almost 50 per cent. higher than normal; therefore hypernutrition is necessary even in the fever-free period. It may be mentioned here, once more, that the dietary requirement in chronic fevers should, before all, provide a sufficient amount of proteids; that the amount of calories should be given in a form agreeable to the patient; and that other considerations play no rôle. Also hydriatic procedures, as cold rubs, cold body compresses, and drugs (orexinum tannicum in tablets, wine of condurango, tincture amara, etc.) are tried in order to overcome the patient's opposition to the forced feeding. This may lead in chronic cases even to a taking on of body substance, as the scales in the tuberculosis sanitariums show every day.

In the treatment of chronic fevers the careful carrying out of a number of measures which fall into the domain of nursing is of greatest importance. Provision for a hygienic, light, well-ventilated room, for a good bed, frequent changes of position, body cleanliness, and an appetizing arrangement of the food play just as important a rôle as the endeavor to influence the mental condition of the patient in a favorable manner, to increase his confidence, or to suppress conditions of excitation and depression.

Treatment of Fever in Disease

Thermometry in Suspected Tuberculosis.—Hochstetter, under the direction of Penzoldt, has shown that afebrile phthisical patients have transient rises of temperature (to 38° C. in rectum) after physical exertion, such as marching, and that this fact becomes important for the diagnosis in cases of suspected beginning tuberculosis. Temperature rises of more than 0.5° C. in the rectum after physical exercise (a march of one hour on level ground), according to Penzoldt, have the same significance, unless the patients are very fat with a tendency, therefore, to heat stagnation.

In opposition to Penzoldt's standpoint, Schröder and Brühl consider the hyperthermia after marching as physiological. The ques-

tion whether these rises in temperature really denote fever is not finally settled. Köhler and Behr are inclined to believe that an increased temperature in phthisical patients is not always actual fever, and believe that the tubercular intoxication brings the central nervous system into a state of such labile equilibrium that "fever" may be caused even by suggestion, for instance through the injection of physiological salt solution believed to be tuberculin.

Overheating.—In addition to the consideration of feverish rises of temperature, the injury and dangers from overheating should be mentioned. Beside the temperature the atmospheric humidity plays a great rôle. Hartwich (Virchow's Jahresbericht, 1885, I, 239) made experiments on himself and others concerning the tolerance for moist heat. Temperatures as high as 81° C. were well borne for a short time, the body temperature rising to 38° C. or more.

Heat stasis is favored by work, since only a small part of the heat of combustion is transformed into work, the rest being added to the stagnated heat.

The disposition to heat stroke increases in circulatory disturbances, such as weak heart, for the conduction of the overheated blood to the periphery, where radiation of heat it effected, is slowed. Heat strokes are oftenest observed in soldiers on the march. At first they walk unsteadily and automatically, then stagger, and finally fall. The pulse is hard and full, later becoming small and very much accelerated; the respiration is stertorous, the face purple and bloated, later pale. The pupils are small at first, but with the increasing danger they often become extremely dilated and do not react. The temperature may rise above 40° C., the blood is considerably thickened; the specific gravity may rise more than six points.

Not to be confused with this is the symptom-complex of insolation or sunstroke. This arises from the local action of the sun's rays on the neck and back of the head, and begins with headache, dizziness, ringing in the ears, and photopsia, as a result of hyperemia of the meninges.

The treatment corresponds to that of heat stroke, since beside the hyperemia of the cerebral membranes, which may develop into a true encephalitis, there is always some stagnation of heat. Prolonged cool baths are given which may be gradually cooled further; the respiration, if insufficient, may be deepened by artificial respiration movements. The heart must be sustained in the usual way by camphor and other *excitants*. Antipyretics are, in general, not indicated. Anderson and Binz recommend giving quinin, and the latter emphasizes, in explanation of the effect, that the heat production is strongly reduced by it.

Undercooling.—Something may be here added on the subject of undercooling and freezing. If a body remains a long time in cold

water the rectal temperature may sink to 30° C., and indeed a case is reported in which it sank to 24° C., and recovery still occurred. The first symptom of freezing is paleness of the skin, as a result of the stimulation of the constrictors; thereupon lividity soon follows, through paresis of the constrictors and the disturbed circulation. Oxidation becomes noticeably lessened, the heart action very much slowed, respiration superficial; the central nervous system responds with prostration, weakness, and somnolence, which may increase to coma; the reflexes are lost; children, old people, and weakened individuals, as well as those under the influence of alcohol (Reineke) succumb with peculiar readiness. According to one view, this is said to result from the paresis of respiration; according to others, from paralysis of the heart. The animal experiments speak in favor of the first view, for animals which have been exposed to severe cold may be kept alive much longer by artificial respiration than without it. The attempts at reanimation consist in rubbing, in artificial respiration, stimulation of the heart, and gradual warming in a warm bath.

Subnormal Temperature.—Not less significant is the spontaneously arising subnormal temperature. Low temperature may involve only the peripheral portions of the body or may at the same time correspond to a low internal temperature. The explanation of both forms of subnormal temperature is not the same. Coldness of the extremities alone is due to disturbances in circulation; for instance, the affected members in poliomyelitis anterior acuta are always very cool to the touch; this is also the case in venous thrombosis and in hemiplegias of long standing. The circulation of warm blood is the chief source of the heat for the periphery. Subnormal temperature in the internal portions of the body can only be determined by placing the thermometer deep in the rectum. It is explained chiefly by a decrease of the chemical changes which we consider as a source of heat, thus by a reduction of the combustion processes. Very often a fatal circulus vitiosus develops which includes both etiological factors, for the narrowing of the cutaneous vessels, by which the organism combats the refrigeration, renders the total circulation more difficult, and therefore that of the lung, and decreases in this way the CO_2 exchange. The hypersaturation of CO_2 in the blood stimulates the vagus nerve and so leads to the slowing of the heart action Therefore, both moments are often present, heart weakness and deficient combustion, creating the picture of subnormal temperature.

According to the classification of M. Löwit, we distinguish:

Subnormal temperature,	36°–36 1/2° C.
Moderate collapse,	35°–36° C.
Deep collapse,	33°–35° C.

In a case of abdominal typhoid in the defervescent stage Wunderlich registered a temperature of 33.5° C. The patient recovered.

Congenital Debility.—The collapse temperature is met with sometimes immediately after birth, as a congenital want of vitality. One of the most frequent causes of it is premature birth when the child does not weigh 2000 gm. and measures less than 42 cm.; but it is also found at the end of a normal pregnancy, in multiple births, and in children of sick parents, for instance, luetic. In such cases the rectal temperature is always very low. With temperatures under 35° C., the prognosis is generally unfavorable. The circulation is usually very poor, so that the skin, especially on the nose, ears, and extremities is colder than would be in accord with the internal temperature and is strongly cyanotic.

The therapy must first aim to conserve the heat. The child is wrapped in material which is a very poor heat conductor (cotton); he should not be bathed or washed in water below 36° C., but surrounded by warm bottles, thermophores, or stone jugs filled with hot water (care for burns). The room temperature is to be as high as possible, as high as the nurse can endure it, and the necessary moisture must be provided. Credé recommends that the child be placed in a tub with double walls through which hot water is conducted. To-day there are a number of incubators which answer excellently the indication for heat economy (Tarnier, Rommel, Finkelstein, Auward). The temperature of the incubator (couveuse) should be maintained at 26° to 28° C., and occasionally at higher temperatures. The rectal temperature must be repeatedly and carefully taken in order to avoid heat accumulation. This is announced by cyanosis, quick respiration, sweating, and restlessness of the child.

In acute infectious diseases the incubator treatment is not to be continued. Hutinel and Delestre recommend that children should not be left too long in the incubator and that they should be removed one or two days after they have reached the normal temperature. By placing a child of low vitality in an incubator, not much is accomplished in itself. One should remember the statement of Delestre: "Tant vaut le milieu, tant vaut la couveuse."

Before all, one must aim to raise the combustion processes of the child's organism. We stimulate its breathing by causing it to cry; we may also employ artificial respiration and seek to avoid hypostasis by frequent change of position. The nourishment must be given often, at two-hour intervals, and should be that most easily assimilated with the highest combustion value (woman's milk). The especially low temperature of the skin in these children, 28.5° to 22° C., according to Keller, leads in the peculiar composition of the subcutaneous fat in the new-born to induration of the fat, fat scleroderma.

Fat Scleroderma.—The treatment consists in baths, as warm as possible, and in the administration of from 10 to 12 drops of tokay wine hourly (K. Keller).

Congenital Heart Lesions.—Hermann Vierordt calls attention to the lowering of the external and internal temperature in congenital heart lesions. Caillot found the temperature of the hands and feet of such patients to be about 31° C; the rectal temperature is also noticeably reduced. Later on, complaints are made of subjective sensations of colds. The course of the temperature curve in the new-born with congenital heart lesions is also of prognostic importance. If the temperature rises, it is favorable. Rauchfuss has called attention to the fact that patients with a constant subnormal temperature nevertheless show high temperatures if they are taken with a severe febrile disease. Adults with cardiac lesions show a similar behavior. They generally have a subnormal temperature which is driven up by slight disturbances.

Afebrile Course of Infectious Diseases in Debility.—Infectious diseases in debilitated children and in senile persons often take an afebrile course, accompanied by subnormal temperature. Steffen considers subnormal temperature suddenly appearing in the first years of life as a symptom of a pneumonia developing in the lower lobe. Collapse temperatures in weak newborn children are at times the result of a septic infection.

Inanition.—In regard to the metabolism of inanition, the combustion is usually not decreased in the first days of fasting. It is only on long-continued hyponutrition that the organism learns how to limit its expenses so that the calorific requirement, and thus the degree of metabolism, sink.

Obesity.—A theory of obesity at present entirely abandoned explains the tendency to an increased deposition of fat by the decreased changes in assimilation. Observations on the temperature in fat people have scarcely shown any reductions worthy of mention.

Nervous Diseases.—Abnormally low temperatures, 28° to 32° C., in the rectum are observed in diabetic coma, in paralysis during the paralytic seizure, as well as in the terminal stages (Reinhard, Krafft-Ebing). In the last days before death one may find rectal temperatures of 22.5° to 32° C.; in melancholia with stupor, the low temperature found by Lamoure is probably the result of the bad respiration and nutrition; in maniacal attacks which lead to exhaustion, with the increased loss of heat in the naked raving patients, the heart weakness certainly plays a part; Krafft-Ebing considers the paresis of the vessels in the paralytic attack as the cause of the subnormal temperature. The immediate influence of the central nervous system

on the heat economy cannot be entirely denied since the discovery of thermogenetic centers in the brain. Especially the pons and the medulla oblongata seem to possess a certain influence in this regard. In an apoplexy in the medulla Lemcke once found a temperature of 23° C. in the rectum.

Hemorrhage.—It is a known fact that very abundant sudden hemorrhages can effect a fall of temperature of 2° C. Bauer considers the diminshed oxidation as the cause of this. Gürber, on the other hand, does not find the consumption of oxygen lessened after severe hemorrhage. R. Muller, in a progressive pernicious anemia, recorded a temperature of 25.8° C. two days before death. However, chronic anemias do not generally lead to subnormal temperature.

Myxedema.—Myxedematous patients register 36° to 37° C. in the axilla and often suffer from chilly sensations. This may perhaps be due to a retardation of metabolism, though similar disturbances in Addison's disease are probably better explained by the adynamia due to the low blood pressure.

Some Infectious Diseases.—It remains still to consider subnormal temperature in certain infectious diseases and intoxications. First, Asiatic cholera. Its well-developed stage is called asphyctic and algid. The internal temperature may be normal or even raised, as measurements deep in the rectum show, but the nose, ears, and extremities are ice-cold, the trunk generally somewhat warmer. This is the type of a peripheral subnormal temperature, due to circulatory disturbances. At the same time, within the body there may exist an accumulation of heat, thus heightened temperature without fever, since the heat produced is not conducted to periphery (Liebermeister). If the internal temperature is also subnormal, then the heat production must have suffered severely from the effect of the toxin, and the prognosis is most unfavorable. A great difference between the external and internal temperature is a bad sign as to the circulation.

In the course of typhoid fever after defervescence, a subnormal temperature always occurs, which lasts the longer the deeper it sinks below the normal. This period, in which normal temperature may signify slight fever, may continue as long as three weeks. Pseudocollapse may also appear, this being a fall of temperature without a rise in the pulse frequency and with marked euphoria. Lysis often follows this pseudocollapse; sometimes, however, a real collapse appears. In any case it demands the most careful observation of the general conditions. For hemorrhage sometimes leads to enormous drops in temperature, as in one case from 41° C. to 35° C. in a few hours. Perforation may also lead to drops in temperature, though not necessarily. In exanthematic typhoid badly nourished individuals often show for several days a gradual sinking of temperature;

sudden steep descents have been observed and have generally a bad prognosis (Curschmann).

In recurrent fever in the apyretic stage subnormal temperature is common following the defervescence, as also in chronic relapsing fever (Pel-Ebstein).

The typhoid type of pernicious malaria often shows subnormal temperature for days. Mannaberg calls this form the adynamic form. In regard to diphtheria, the frequency of subnormal temperature in the septic form, as well as the striking coldness of the extremities preceding the heart death, deserve mention. Septic diseases often show in the course of the fever marked variations from the normal with subnormal temperature, just as the hectic fever of phthisical patients sometimes increases near the end.

Subnormal temperature after the opening of a pyemic focus is of favorable prognosis, often preceding the process of healing. Transient falls of temperature below normal following an initial rise are to be observed in the course of basilar meningitis when the vagus has become involved (Heubner, Soltmann).

Cachexia.—Chronic wasting diseases, cachexia, and marasmus lead to somewhat subnormal temperatures which may persist for a long time.

Treatment of Subnormal Temperature.—In the above we have considered the different causes and the varying significance of subnormal temperature. The treatment has always the same weapons, more or less energetically applied: friction with hot cloths; mustard poultices on the calves; warm bottles, wine, warm baths, and heart stimulants. Some prophylactic hints may still be given. Wet packs must be discontinued at once if strong sweating occurs, as, on account of the atony of the cutaneous vessels, the cooling off has occurred too energetically (Henoch, "Deutsche Klinik)."

The precautions directed against the occurrence of collapse which we have recommended in the case of the antipyretic baths are to be observed here. For the rest we must refer to the prophylaxis and therapy in heart weakness.

Intoxications.—In regard to intoxications, an important part of the therapy of collapse temperature coincides with the treatment of the intoxication itself. The resemblance between acute arsenic poisoning and Asiatic cholera (stadium algidum) may be mentioned here. Subnormal temperature would be expected, theoretically, in the intoxications which inhibit oxidation, as in CO_2 poisoning. Carbon monoxid poisoning inhibits the oxygen-carrying power of the hemoglobin, but leads, as v. Jaksch has shown, to an increase of temperature.

Subnormal Temperature in Children.—Something may still be added concerning collapse temperature and its treatment in children.

If the limbs feel cold as a result of cyanosis and circulatory disturbances, a warm bath with two handfuls of mustard often gives surprisingly good results; somewhat less effective is the mustard pack of the trunk. Mustard is placed in a bag and floated in water not too hot until a pungent odor develops. In this the cloth for the pack is dipped. The cloth must be close about the throat, as otherwise conjunctivitis may easily develop. It must remain ten or at the most fifteen minutes.

Subnormal temperature in the course of severe gastroenteritis is combated conjointly with the diarrhea, since the latter is indirectly the cause of the coldness of the peripheral parts. Infusions with physiological salt solution at 39° C., from 50 to 200 c.c., tinctura strophanti 1 to 2 drops internally three times a day according to the age of the child, heavy wine, black coffee, subcutaneous injections of ether, camphorated oil, strychnin, and caffein may be tried.

For further details see the chapter on Cardiac Weakness.

CHAPTER II

DISTURBANCES OF THE HEART ACTION

General Remarks on Circulatory Disturbances.—Manifestations on the part of the circulatory organs are generally associated, seldom occur alone, and in many cases depend on each other. It is therefore scarcely possible to discuss separately each symptom which arises from disturbances of the circulation; hence, we will consider the whole complex of symptoms together, as they will be best comprehended in accordance with their genetic development.

We have to deal, on the one hand, with disorders on the part of the heart itself; on the other hand, with changes in the peripheral vascular system, which has, as newer research has shown, a greater independence than was supposed until recently; therefore some investigators distinguish, beside the heart as the central organ, a peripheral heart, which if paralyzed may cause as great danger as if the heart itself were paralyzed.

Besides the mechanical element, infectious and toxic injuries of the heart muscle and of the vasomotors, as well as influences on the part of the nervous system, which of themselves may have a very complex origin, play an important part in the origin of circulatory disturbances.

First of all, we have to consider cardiac weakness. Jürgensen gives the following definition: "A functional incapacity of the heart which causes such a retardation of the circulation that the tissue respiration becomes insufficient." If this symptom-complex is markedly developed a circulus vitiosus is established, since the nutrition of the heart itself must suffer through the disturbed circulation.

In cardiac weakness the frequency of the heart action generally increases and is usually accompanied by a diminution in the output (Schlagvolumen) of blood. This tachycardia, according to Tigerstedt, is brought about chiefly at the expense of the diastole, for the diastole and the heart pause appear considerably shortened. If we now remember that the heart is most filled with blood during the diastole, it is clear that a tachycardia interferes with the nutrition of the heart to a certain degree. Thus there is a lowering of the heart's reserve force which, according to the investigation of Benno-Lewy, may accomplish thirteen times as much work as the heart during rest.

CAUSES OF CARDIAC WEAKNESS

The causes of cardiac weakness may be divided into two chief groups, the first of which embraces the disorders of the mechanism of the heart action, whereas the second group is due to an insufficient blood supply to the heart.

I. Injured Mechanism of the Heart Action

(*a*) **Trauma.**—In injuries of the heart, death occurs sometimes suddenly without any extensive hemorrhage to account for it; in fact, the time would have been too short to permit such a large quantity of blood to effuse into the pericardium that it could by compressing the heart hinder its diastolic repletion and cause sudden death. It is not yet entirely understood whether the sudden arrest of the heart is brought about by irritation of the vagus, by a paresis of the splanchnic nerve causing a rush of blood to the great blood reservoirs of the abdomen, or by concussion of the heart muscle bringing it to a standstill automatically. It is certain that relatively small quantities of blood, from 150 to 200 c.c., effused into the pericardium acting as a tampon may lead to death.

(*b*) **Spontaneous Rupture.**—Rupture of the heart has been found sometimes at postmortem after sudden death; in these cases a severe pathological change must have been present in the wall of the heart, for an increase of pressure, however great, cannot bring about bursting of the healthy cardiac muscle. This is, however, possible if myomalacic foci are present, which lead to the formation of a cardiac aneurysm, and in some cases even to a spontaneous rupture of the heart.

(*c*) **Compression of the Heart.**—Not only effused blood, but an exudate or a transudate as well, especially if rapid, may cause such an increased pressure in the pericardium as to become incompatible with life, because the diastole of the heart is prevented. Puncturing the pericardium may remove the immediate danger to life. In general, hydropericardium will have to be considered more dangerous than pericarditis; for the hydropericardium indicates, *per se*, a very severe deficiency in the heart force, especially if developed through cardiac stasis. Beside the hydrops pericardii, effusions into the other serous cavities have to be considered with regard to their fatal effects on respiration and circulation. Of pericardial effusions, the most dangerous are the purulent ones, since in such grave inflammatory changes of the serosa the underlying muscularis is also generally involved to a serious degree.

(*d*) **Other Causes of Hindered Contraction.**—Fat covering the heart in a thick layer or growing through its muscular substance hinders the heart action; indurations, tubercular nodules, gummata, or new

growths of the cardiac muscle may exert an unfavorable influence on the heart, mechanically counteracting its contractibility like dead masses lying in its walls. These formations may occasionally cause an indirect interruption to the normal course of the heart action by pressure on the cardiac vessels or nerves. It is furthermore readily understood that adhesions with the pericardium and progressively with the adjoining tissues embarrass the systole.

(*e*) **Air Embolism.**—The contents of the heart cavities may also be the cause of damage to the heart action. In case of negative pressure, air may be aspirated into the brain, especially during inspiration, for instance, if, during an operation, a small lesion occurs in one of the cervical veins. Heineke called particular attention to the great danger of sponging the veins in operative procedures on the neck. In the uterine veins air emboli may occasionally develop after separation of the placenta. The danger of air embolism depends less on the quantity of air which has entered the veins than on the time consumed in its entrance, for the oxygen may be resorbed from the air mixture and, provided the entrance of the air was slow, the heart may succeed in pressing the air vesicles into the circulation; here, however, especially in the capillaries, they furnish a great obstacle to the blood current, rendering the supply of oxygen difficult. The clinical picture of air embolism may be given in this place: The patient turns suddenly pale, his pulse becomes small, filiform, sometimes undulating, under some circumstances signs of cerebral irritation appear, as opisthotonos and convulsions. To prevent a fresh entrance of air and remove imminent danger by artificial respiration and massage of the heart should be the first aim.

(*f*) **Heart Thrombus.**—A thrombus may at times lead to severe circulatory disturbances, causing for a certain period symptoms of mitral stenosis if it has developed in the left auricle; it may cause sudden death by complete obturation of the orifice. The thrombi found may be pedunculated (heart polypi) or round and spherical.

(*g*) **Pulmonary Embolism.**—Thrombi of the rightheart especially, but also those of the venous system, as of the femoral vein, may lead to sudden death from circulatory disturbances; once loose in the blood stream, they are carried to the pulmonary artery and there obstruct some large branch. The vascular system possesses, it is true, a remarkable faculty of adaptation when vessels are obturated. Lichtheim makes the statement that the system of the pulmonary artery may be obstructed in three-quarters of its course without necessarily causing a fall of pressure in the carotid artery; therefore embolism may cause no severe manifestations if it develops slowly. If in the beginning a severe circulatory disturbance exists, this may be corrected, as the other branches of the pulmonary artery dilate and the

right ventricle removes the disturbance for the most part by increased work. Jürgensen's observation is of interest that in weak heart the manifestations of pulmonary embolism are not generally very turbulent, for the plugging of the vein by the embolus occurs with less force if the heart action is weak.

(*h*) **Injuries of the Heart Action.**—1. *From Coronary Sclerosis.*—Very important for the undisturbed continuance of the heart action is the integrity of the coronary vessels. If the heart is properly nourished and receives enough building material to produce hypertrophy of its musculature, it can overcome very considerable obstacles in the peripheral vascular system. But the moment a general arteriosclerosis, which itself demands a great deal of the cardiac force, attacks the coronary arteries, the nourishment of the cardiac muscle suffers, and if the latter has once become injured every possibility of reparation through compensation is excluded. If the narrowing of the cardiac vessels is of a high degree or if complete atresia is present, the portion of the heart muscle supplied by them is destroyed through mild myomalacic degeneration, and cardiac callosity takes the place of the muscle element.

2. *By Heart Poisons.*—Numerous poisons exert their deleterious effects first on the cardiac muscle. This is true of digitalis, whose action on the heart muscle may be used curatively if given in the proper dose and in the right case; further, the heart muscle may be severely injured by phosphorus. The abuse of tobacco and alcohol may be mentioned as other examples of the toxic injuries to the heart. In the latter we have not only to deal with the specific action of alcohol, but also with the damage done from the abundance of liquid taken in, as will be discussed in detail later on. This factor plays a rôle especially in the pathogenesis of the beer heart.

3. *By Infection.*—Bacterial toxins may act in the same manner as these poisons, introduced from without, seriously affecting the musculature of the heart. Examples of this occur in diphtheria, scarlet fever, small-pox, and typhoid fever.

4. *From Deficient Composition of the Blood.*—If the composition of the blood is faulty the external muscles will be insufficiently nourished, and great weakness and debility will result, as we observe commonly in grave anemias; in the same way the cardiac muscle is affected when the composition of the blood is inadequate. We observe this after severe losses of blood as long as great hydremia persists. Further, in all disorders which are followed by a lack of hæmoglobin in the blood; these may be severe, for instance, pernicious anemia, chronic Bright's disease, or some of those wasting diseases leading to pronounced cachexia, in which protoplasmic poisons are supposed to be present which lead to the disintegration of protein

substance (Friedrich Müller). In the last case, however, we may explain the cardiac weakness also by the direct toxic injury to the protoplasm of the heart muscle.

(*i*) **Nervous Influences.**—Since the circulation is regulated by nervous influences, these may lead to serious disorders of the circulation. They may affect the heart itself or cause changes in the peripheral current. The experimental foundation for reflex influence on circulation is the celebrated experiment of F. Goltz. By beating on the abdomen of a frog an inhibition of the heart is brought about, due to the stimulation of the sensory nerve endings in the abdominal organs.

Similar phenomena may be seen at the sick-bed, where a beginning perforation of the intestine may be recognized by the action of the pulse, or when instantly after intoxication with caustics or acids the most severe condition of cardiac weakness is found. On the other hand, the influence of psychical excitation in bringing about attacks of faintness in persons so predisposed proves how much the cortex of the brain controls circulation. We shall in another place have occasion to speak more in detail of the influence of the nervous system on the circulation.

II. Disturbances in the Blood Supply

An insufficient nourishment of the heart usually results when the ventricles are insufficiently filled during the diastole. This is commonly seen in overexertion of the heart where, though the ventricles are greatly dilated, the difference between the heart volume in systole and in diastole is a very small one or, expressed more briefly: "The contraction volume is diminished." In this way one ventricle receives from the other an insufficient quantity of blood. Valvular lesions, insufficiency, and stenosis may prevent the filling of the ventricles, as in stenosis of the venous orifices; or they may hinder the complete emptying of the ventricles into the big vessels from stenosis of the arterial orifices, in insufficiency of the semilunar or tricuspid valves. It is clearly understood that every circulatory disorder located at an orifice first exerts an unfavorable influence on that part of the heart lying directly before it, but that very soon the whole heart will be affected sympathetically if the part first used for compensation has given way. Reflecting the great influence of the thoracic movements on the circulation, we may consider the muscles of respiration in a certain sense as auxiliary muscles of circulation; for that reason everything that hinders the expansion of the lung will at the same time render the work of the heart more difficult. Therefore those morbid processes which, developing slowly, prevent this expansion of the lung, as cirrhotic processes, pleural adhesions, etc., will lead to stasis in the

venous system and in the pulmonary circulation and subsequently to hypertrophy of the right ventricle. Acute processes, as pneumonia, for instance, do not allow time for hypertrophy to develop, only for dilatation, especially of the right heart, and this the sooner as the coexisting high fever, *per se*, increases the demand on the circulation.

Every increase of pressure in the abdomen, meteorism, entrance of air into the abdominal cavity, the presence of free fluid, as well as similar processes in the thoracic cavity, will influence unfavorably the flow of the venous blood to the heart. In these changes, the diaphragm, hindered in its descent on inspiration, helps to increase the unfavorable action.

We shall now, having given a brief outline of the causes of cardiac weakness, speak of its clinical picture. To understand this it is necessary to analyze the different symptoms which constitute the symptom-complex of cardiac weakness.

THE PULSE UNDER NORMAL AND PATHOLOGICAL CONDITIONS

First in importance is the condition of the pulse. In the pulse, which we commonly take on the radial artery, we distinguish the following qualities: We have first to observe if the course of the artery is straight or winding and if the arterial wall is soft or rigid; we then observe the filling and tension of the vessel, the frequency of the pulse, its rhythm, and finally other qualities to be discussed later.

Frequency of the Pulse.—The frequency of the pulse, even under normal conditions, varies greatly. In the first place, age is of great influence. The new-born has about 130 beats; this number sinks after the first to the second year to 110, in the third to the fourth year to 108, in the fourth to the fifth to 103, in the sixth to the seventh to 92, in the twelfth to the thirteenth to 88 (H. Vierordt). The frequency decreases with progressing age, and only after the sixtieth year does it again begin to increase a little. It varies also in the different sexes and in different sizes of the body, women having usually a few *more* beats in a minute than men; small persons may have a more frequent pulse than tall ones. Furthermore, the position of the body is of influence, the frequency of the pulse generally increasing if the lying position be changed to a sitting one, and still more if the sitting be changed to the standing one. The daily variations in the pulse-rate go parallel with the daily physiological variations of the body temperature; an acceleration of the pulse during the time of digestion is a usual finding. The rise in the pulse rate after physical exercise of any kind is well known and in cases where cardiac weakness exists, slight movements which normally are not felt at all as an exertion may

bring about a marked increase in frequency. In sensitive patients the psychical factor has to be considered, the examination made by the physician often being sufficient to augment the pulse-rate quite considerably. A small acceleration of the pulse in psychical excitation is physiological.

Tachycardia.—*Pregnancy.*—The number of diseases accompanied by an increase in the frequency of the pulse is very great. The term tachycardia is used only when the augmentation is considerably higher than the normal (one-fifth higher, according to Fr. Kraus). The tachycardia of *pregnancy* must be mentioned first, being on the border-line of the physiological. We observe it further in persons exposed to a high external temperature, analogous to the dyspnea produced by heat.

Febrile Tachycardia.—The tachycardia in febrile diseases is not entirely dependent on the height of the fever, and therefore cannot be accounted for by the increased heat of the blood alone. However, in general a certain regularity may be observed. In a great number of cases we find Liebermeister's rule confirmed, that in the adult about eight pulse beats are equivalent to an increase of temperature of one degree centigrade.

Bacterial Toxins.—Beside the rise of temperature, the specific microbes of acute febrile diseases surely play an important rôle in causing tachycardia. Further, we have to take into account the special reaction of the individual. We sometimes find phthisic patients, with hearts absolutely intact, exhibiting only slight increases of temperature, as 38° C., but showing a pulse so rapid as to be otherwise seen only in highly febrile conditions. The agents which produce fever may at the same time injure the circulatory apparatus through the formation of toxins, as in scarlet fever, diphtheria, and influenza. Indeed we find, not uncommonly, a great increase in the frequency of the pulse in the afebrile course of severe general infections, for instance in Asiatic cholera, cholera nostras, septicemia, and septic diphtheria.

In typhoid fever, on the other hand, a characteristic relative bradycardia is the rule, at least in adults. Typhoid fever in children shows a somewhat different course: until about the tenth year of life, the curve of temperature and of pulse do not show the characteristics found in adults.

Paralysis of the Vagus.—We have to expect tachycardia, further, in all those affections of the vagus nerve or of its center in the medulla oblongata in which the functional capacity of the nerve is lowered. This usually follows upon a period of increased excitability. In such a case we observe first, bradycardia caused by irritation of the cardio-inhibitory nerve, changing later into tachycardia. This may often be seen very markedly in the course of a meningitis.

Graves' Disease; Paroxysmal Tachycardia.—Tachycardia is one of the cardinal symptoms of Graves' disease. In heart neurasthenics a very markedly increased pulse-rate may be found, as also in traumatic neurosis, probably from psychical interaction. Different from all these forms of tachycardia is the essential or paroxysmal tachycardia, which we shall discuss later more in detail; in this disease the highest pulse-rate is found—200 and more during the paroxysms, though the free intervals show a normal rate.

Bradycardia.—The opposite condition to the phenomenon of tachycardia is the retardation of the pulse-rate—bradycardia. Whenever a retarded action of the heart is observed in the radial artery, we ought to convince ourselves by auscultation of the heart or by palpation of the apex beat that we have in fact to deal with a delayed action of the heart and not with that not uncommon condition in which only each second contraction of the heart generates a pulse-wave palpable in the periphery. Generally in an adult we should consider a pulse-rate below sixty as pathological (Romberg); this rule has, however, its exceptions (v. Schrötter). Like tachycardia, bradycardia may be brought on by nervous influences if the cardio-inhibitory nerve, the vagus, is irritated at its center, in the periphery, or in its terminations in the heart.

A direct action on the heart muscle may also lead to bradycardia. v. Neusser distinguished three sources of origin for this cardio-muscular bradycardia.

1. Lowered automatic excitability of the cardiac muscle, through fatigue, exhaustion, or toxic influences.

2. The hindered conductibility of the cardiac muscle in insufficient nutrition, due to the effect of toxins, irritation of the vagus, or heart-block on the atrioventricular border.

3. The hindered contractility of the cardiac muscle from anatomical lesions, as myocarditis, fatty heart, sclerosis of the coronary artery, and destructive poisons. We have a convenient method of discriminating between the various forms of bradycardia. If we can remove the bradycardia by injections of atropin we have to deal with an irritation of the vagus, whereas we are entirely incapable of increasing the frequency of the pulse with atropin if the cardiac musculature itself has suffered.

From Poisons.—A form of bradycardia carefully investigated experimentally is the bradycardia sometimes found in intoxication with tobacco; generally, however, one finds tachycardia and arrhythmia, contrary to the findings of experimental pathology. But we must bear in mind that a great difference exists between the chronic intoxication with tobacco and the experimental effect of nicotin. Chronic lead poisoning is another frequent cause of bradycardia, and

the slow, wiry, hard pulse is an essential feature in the clinical picture of lead colic. Further, bradycardia may be observed if those drugs which are given with the intention of slowing the heart action, are used too long or in too large doses; only in a moderate degree of intoxication, with digitalis, strophantus, and the like, a slow pulse appears, whereas in severe rapidly fatal poisoning the pulse is generally very frequent. In prescribing digitalis especially, we have to bear in mind its cumulative effect, as otherwise we may be surprised one day to find a strikingly slow pulse.

From Autointoxication; Postinfectious Bradycardia.—Some autointoxications may cause bradycardia, as the intoxication with bile acids, common in obstructive jaundice, uremia, and enterogenous autointoxications, as sausage poisoning. Of further interest is the postinfectious bradycardia, which in a broader sense is also toxic in origin; it occurs during convalescence from various infectious diseases, as rheumatism, pneumonia, typhoid fever, scarlet fever, diphtheria, and influenza. Generally of minor importance, it may after diphtheria point to degeneration of the myocardium or to a neuritis of the vagus; retardation of the pulse as well as acceleration with arrhythmia may announce the fatal collapse of the heart following diphtheria. A very pronounced bradycardia may be found in the course of influenza, as the observations of Barthelemy and Vogl in a great number of cases show. It sometimes follows insignificant infectious diseases, as epidemic parotitis.

Heart-block.—"Heart-block" is better understood since we have been able by means of the X-ray to follow up the heart action *in vivo*. We observe that the auricles pulsate more frequently than the ventricles; as v. Neusser expresses it, there exists a hindrance of conductibility at the auriculoventricular boundary, which clinically is equivalent to the block of the ventricles. The explanation of this phenomenon lies in the incapability of the cardiac muscle fibers to conduct further the excitation received from the auricles.

Sclerosis of the Coronary Artery and of Other Vessels.—In sclerosis of the coronary artery, as well as in arteriosclerosis without particular involvement of these vessels, bradycardia is not seldom observed. We find the most pronounced retardation of the pulse when a severe nutritive disorder of the cardiac muscle results from insufficient penetrability of the coronary vessels; the retardation of the pulse commonly changes to tachycardia with the advance of the injurious action, as, for instance, in certain heart poisons, where we find bradycardia progressively increasing until death.

Severe Mitral Stenosis.—In very severe cases of mitral stenosis we sometimes observe a slow heart, where a sufficient diastolic filling of the left ventricle is made possible only by retardation of the contraction.

Reflex Bradycardia.—We have still to speak of the reflex bradycardia produced by any irritation transmitted to the vagus nerve. This is demonstrated in the animal experiment, but also clinically, in gastric ulcer, when the stomach is inflated, and in a great many other painful affections of the abdomen, as well as of other parts, as, for instance, in severe neuralgia. The peritoneum is an exception, for irritation of it is constantly followed by tachycardia.

Arrhythmia and its Various Forms.—*Pulsus deficiens.*—We judge of the rhythm of the heart action by taking the pulse and by auscultating the heart sounds. Generally we prefer the latter method, for our ear is more accustomed to perceiving rhythm than our sense of touch; therefore we are able to establish deviations from the normal which escape the palpating finger. Beside this, there are other reasons for controlling the rhythm of the pulse by auscultation of the heart sounds. The omission of a pulse beat may really correspond to the omission of a contraction of the heart; but in other cases the contraction is not omitted, but is so weak that the wave cannot be felt in the radial artery. This phenomenon is not of great significance; one finds it, for instance, occasionally in corpulent people despite the absence of serious disorders on the part of the vascular system.

Pulsus intermittens.—We distinguish chiefly two kinds of changes in rhythm. Either the intervals between the single contractions are of different duration or the heart beats are irregular in force, so that the pulse becomes unequal; generally both phenomena exist together, so that a heart revolution which follows the preceding one too quickly is usually also less forceful.

In respect to the intensity of the irregularity we have to distinguish the absolutely irregular pulse, usually of very high frequency, in which one pause is scarcely like another (*Delirium cordis*). In other less marked cases of arrhythmia several regular beats are interrupted by irregularities, which may or may not show a certain system. Though in cardiac defects severe arrhythmia points, as a rule, to compensatory disturbance, we find sometimes in mitral lesions, in insufficiency or stenosis very pronounced irregularities of the pulse without any compensatory disturbance.

Pulsus myurus.—Of the different well-defined pulse anomalies we may mention the following: The pulsus myurus, a pulse form in which a series of continually decreasing waves follows a full beat; this diminution led to its comparison with the tapering tail of a mouse. Sometimes the last waves of such a period become so small that they cannot be felt at all, analogous to the Cheyne-Stokes respiration, in which the respiration becomes weaker and weaker until apnea results. In such cases we speak of a pulsus myurus deficiens. If the order is reversed, so that the wave lengths increase progressively, we may designate this

as pulsus myurus recurrens, and if a short pause precedes the first small waves, as pulsus myurus deficiens recurrens.

Pulsus incidens.—Since Albrecht v. Haller, we understand by pulsus incidens a pulse beat which augments steadily, beginning with the normal wave length; he compared it with the breakers of the sea, where each wave periodically is followed by a greater one.

Pulsus intercurrens.—Pulsus intercurrens sive intercidens is that form of irregularity in which, following a series of equal pulse beats, a different beat suddenly occurs as if intercalated. The diagnostic significance of this anomaly is generally not very great, since we meet with it not only in the different severe disorders of the heart action, but also in healthy persons in a state of mental irritation; further, in neurasthenics, in persons given to the abuse of alcohol and tobacco in whom there are severe changes in the heart; also in severe disturbances of the gastrointestinal tract, for which reason the old physicians designated this form as pulsus stomachicus.

Bigeminal Pulse.—In the bigeminal pulse each normal pulse beat is succeeded by a weak or abortive one. If two or three such weak beats of the abortive type follow each other one speaks of a pulsus trigeminus or quadrigeminus. The pulsus trigeminus was known in earlier times as pulsus conturnisans, because its dactylic rhythm reminded the old physicians of the call of the quail. The regular interchange of strong and weak heart contractions is known as pulsus alternans. All these last-mentioned arrhythmias, in which a certain regularity exists in their irregularity, may be summarized under the name of allorrhythmia. Riegel has shown that they are of no special significance since they occur in minor disturbances of compensation, as well as in organic diseases of the heart, in arteriosclerosis, in diseases of the heart muscle, in anemia, cachexia, different abdominal diseases, and after acute febrile diseases.

Formerly irregularity was supposed to be due to abnormal innervation of the heart, but at the present time we are inclined to ascribe to the heart muscle itself the faculty of automatic regulation without intervention of the vagus, the sympathetic, or the cardiac ganglia. Therefore, we see the cause of the irregularity in affections of the heart muscle fibers themselves.

Extra Systole.—Wenkebach has called attention to the fact that irregularity of the heart very often results from the so-called extra systole. We understand thereby premature systoles which lead up to a condition, in which the normal irritation to the following cardiac contraction meets the heart in a state in which it cannot respond with a contraction, and therefore the next normal systole is omitted and only the second next systole appears. The normal automatic cause of the heart action is therefore not entirely disturbed, but only suffers

one interruption, and its irregularity shows itself in the subsequent rhythmic contraction. Wenkebach has therefore proposed the name of pararrhythmia. This irregularity may bring about paroxysmal arrhythmias, which may last minutes or days.

Lommel believes that extra systole occurs when the blood pressure is abnormally high and the heart muscle in a state of increased tension. Sometimes, however, it is not high blood pressure but organic changes in the cardiac muscle which lead to extra systole and, in rare cases, nervous disorders.

Significance of Arrhythmia.—*Pulsus paradoxus.*—Most authors, as Riegel, Ebstein, and Krehl, are of the opinion that the significance of arrhythmia has been overestimated, since not only organic heart diseases but also functional disorders may lead to it. It must be mentioned here that the normal pulse is not always entirely rhythmical, the pulse frequency increasing on inspiration and falling again on expiration. In opposition to this, Griesinger and Kussmaul have called attention to the pulsus inspiratione intermittens, in which the pulse fails entirely on inspiration or at least becomes smaller in volume. Kussmaul has given the explanation for this phenomena that the great veins emptying into the heart are stretched on inspiration, which may occur especially in indurative mediastinitis. This symptom, however, is found not only in a great many diseases of the respiratory and circulatory organs (myocarditis, convalescence after infectious diseases—Riegel), but sometimes under entirely normal conditions. There are a number of people in whom during deep inspiration the pulse fails entirely, so that the significance of this phenomenon is a minor one; still it occurs more pronouncedly in air-hunger and in the negative pressure in the thorax during operation (Riegel).

In neurasthenic individuals the influence of the respiratory act on the cardiac rhythm is much more pronounced, the heart action at the height of inspiration becoming much accelerated. The same phenomenon may be observed in acute infectious diseases after the decline of fever, especially in convalescence after typhoid fever. The pulse during the fever itself is generally quite regular, often, indeed, more so than under normal conditions (Lommel). Arrhythmia is usually associated with slowing of the heart action, as is the case in postinfectious bradycardia and in many cases of neurasthenia.

In organic cardiac diseases this respiratory arrhythmia is much more rarely seen; it is often met with in nervous diseases, chiefly in organic affections of the brain.

The idiopathic form of arrhythmia occurs in children; it corrects itself in the course of a few years. Escherich could not find the movable heart described by Rumpf, but he did find a shifting of the absolute dulness of the heart at its upper border. Rosenberg calls this ar-

rhythmia, occurring between the twelfth and fifteenth year of age, the "arrhythmia of puberty."

Tension of the Pulse.—*Pulsus durus; Pulsus mollis.*—Of greatest importance for the practitioner is the tension of the pulse. We distinguish a high tension or hard pulse (pulsus durus) and a low tension or soft pulse (pulsus mollis). The arterial tension may be different in systole and diastole. Thus the fever pulse, usually of low tension during diastole, becomes rather hard during systole, whereas in chronic nephritis and in arteriosclerosis the tension is in both phases abnormally high; in insufficient heart power in both phases low. An exact estimation of the arterial tension is only possible by means of special apparatus, whose description and worth will not be discussed in this book. For practice the instruments of v. Basch (sphygmomanometer) of Gärtner (tonometer) and of Riva-Rocci (especially Stanton's modification) deserve recommendation for their simple manipulation. On long-continued practice one succeeds without apparatus in forming an opinion of the arterial tension, sufficient for prognosis and for the indications for treatment. The digital examination of the arterial pressure is best made by palpating the radial artery with both index-fingers placed next to each other; the proximal finger compresses the artery until the distal finger does not feel any diastolic arterial pressure. Only in those rare cases in which through an abnormal formation of the palmar arch the blood-wave can extend from the ulnar artery to the distal palpating finger, this method of examination cannot be used. In this case another artery, for instance, the temporal artery, must be used for examination. The estimation of the arterial pressure is not only very important, as it enables us to venture a diagnosis of nephritis even before the urine is examined, but it is indeed a safe indicator for the use of a heart tonic, advocating in some cases its administration, in others speaking for its discontinuance, thus, for instance, protecting us against the cumulative effect of digitalis.

Size and Shape of the Pulse.—*Pulsus celer; Pulsus tardus.*—The size and shape of the pulse-wave is valuable to us, and should be ascertained, if possible, without the help of a graphic method. The pulsus celer (Corrigan or water-hammer pulse) is characteristic for aortic regurgitation; the pulsus tardus for aortic stenosis.

In fever this arterial tension is usually decreased and we find, therefore, a certain celerity of the pulse which does not necessarily signify special changes in the aorta.

In arteriosclerosis the rise of the pulse-wave is rapid as long as the hypertrophied left ventricle is capable of its full function; its fall is accomplished slowly. In an especially high grade of arteriosclerosis we find a pronounced pulsus tardus, also occasionally in Bright's disease of very long duration.

Elevation of Elasticity and Back Stroke.—*Dicrotism.*—The form of the elevation of elasticity and of the back stroke can only be studied by analyzing the sphygmographic tracings; only by this means can we distinguish a hypodicrotic, a full dicrotic, or hyperdicrotic pulse, or whether a monocrotic pulse is present as a result of the enormous increase in pulse frequency. However, if we are skilled in taking the pulse we may detect dicrotisms on palpation only. To understand this phenomenon we must remember that the dicrotic pulse can be produced experimentally. Through the effect of cold, the size of the pulse-wave decreases as a result of the contraction of the arterial tube, and only after some time the opposite condition sets in. In this case, and if the heat has been applied from the beginning, the tension of the arterial wall is lowered, resulting in a very marked back-stroke elevation (Winternitz). Dicrotism, as Marrey emphasizes, is only the exaggeration of a normal manifestation due to relaxation of the vessel wall. This also explains the occurrence in fever, in which the dicrotism is certainly independent of the acceleration of the pulse; Riegel occasionally found dicrotism in malaria, without a simultaneously existing tachycardia. However, the dilatation of the capillaries, as found in fever, may play some part in the origin of the dicrotic oscillation. Since lowering of the arterial tension leads to dicrotism, we will find it after severe hemorrhages and, entirely locally, in certain vascular regions where bleeding exists. In general the dicrotic wave is of more frequent occurrence in young individuals than at a later age, since arteriosclerosis hinders its appearance.

A touch of dicrotism, only sphygmographically demonstrable (hypodicrotism), may be found at temperatures of about 39°, while at 40° the pulse is generally fully dicrotic. If the temperature rises still more the pulse becomes hyperdicrotic; that is, the valley between beat and secondary beat is deeper than that between the secondary beat and that following.

The occurrence of dicrotism naturally is dependent upon the irritability of the vasomotor nerves. If the temperature is high and at the same time a contraction of the small vessels exists, as we find it at the onset of a malarial attack, the elevation of the back stroke is very low, the elevation of elasticity, on the contrary, very pronounced.

The study of dicrotism at the end of acute febrile diseases and in the course of chronic diseases is interesting. In the first case Riegel has shown that the normal arterial tension again appears only on subnormal temperature and that through the altered irritability of the vasomotors the normal temperature produces those changes which otherwise we have occasion to see only in fever. In chronic febrile diseases O. J. B. Wolff finds the normal radial pulse only at subnormal temperature; at normal temperature a back-stroke elevation corre-

sponding to that found in slight febrile conditions; and in slight fever he finds a dicrotic wave which we are accustomed to see otherwise only in high fever. The vasomotor system reacts in such cases through its lability earlier than under normal conditions. Occasionally one may find after intoxication with amyl nitrite, pilocarpin, and morphin, dicrotism caused by the lowering of the blood pressure, whereas in those intoxications associated with increased vascular tonus, as, for instance, in digitalis and ergotin intoxications, the back-stroke elevation becomes indistinct.

Anacrotism.—By anacrotism we understand, with Landois, notches occurring in the ascending limb of the pulse-wave before the apex is reached. These serrations are of course only to be seen in the sphygmographic tracings. In general we may expect to find them only when the systole lasts sufficiently long for the vessel walls to produce oscillations during their diastolic dilatation; therefore, this phenomenon may be present in dilatation and hypertrophy of the left ventricle, for instance, in the course of a chronic interstitial nephritis as well as in retardation of the circulation in paralyzed extremities; further, after compression of an artery or after ligation of a peripheral vessel when a collateral circulation develops.

In aortic regurgitation one sees at times anacrotic waves, for which another factor besides the hypertrophy of the left ventricle may account. In this lesion the arterial orifice is constantly open and therefore not only the contractions of the ventricle, but also those of the auricle are transmitted to the pulse wave; these two elevations following immediately upon each other lead to the step-like form of the ascending limb.

Also in aortic stenosis we may find anacrotism as a result of the long duration of the ventricular systole. In mitral regurgitation with its small weak pulse dicrotism is more common.

Importance of Examination of Other Arteries in Arteriosclerosis.—Since the diagnosis of arteriosclerosis generally depends upon palpation of the accessible arteries, it is well to remember that the distribution of arteriosclerotic changes may be very irregular, and the radial is above all not one of those vessels which are early or to a high degree involved. One should guard against excluding arteriosclerosis because of the normal condition of the radial artery and should examine all other arteries which are palpable. In this connection it must be remembered that the superficial temporal artery may have normally a tortuous course and that this alone should not mislead one in the diagnosis of sclerosis of the arteries. Often the examination of all accessible arteries deceives us and the patient will die from the consequences of sclerosis of the branches of a vital vessel when through palpation we were unable to prove the existence of this condition.

EXAMINATION OF THE HEART ITSELF

Apex Beat.—The routine examination of the heart is always begun by looking for the apex beat. This, under certain circumstances may be feeble or not felt at all, but this does not justify us in assuming the presence of cardiac weakness or of any other circulatory disorder. This behavior is to be observed, if the apex of the heart strikes against a rib, or in emphysema, in pericardial effusions, in pleural exudate of the left side, in pneumothorax, in separation of the heart from the chest wall by tumors or by mediastinal emphysema, or in edema of the anterior chest wall. If all of these factors can be excluded, we have to conclude that a high degree of cardiac weakness exists, especially in those cases where the strength of the apex beat diminishes rapidly or disappears entirely. In those conditions, however, in which we do not know the previous condition of the patient, we must support this diagnosis by every other means and especially by examination of the pulse.

On the other hand, the apex beat may be exaggerated, without justifying the conclusion that the heart action is increased or that hypertrophy is present, as in dilatation of the heart cavities or even in pronounced cardiac weakness. In these cases, too, examination of the pulse gives the key to the situation. It is indeed characteristic of certain forms of acutely developed cardiac weakness that an exaggerated impulse of the heart is followed by a very weak pulse. If the heart action again improves, as may be felt on the pulse, the heart diminishes in size, does not lie in such close proximity to the chest wall and therefore the apex beat again diminishes in force. An augmentation of the apex beat may be caused by changes in the surrounding organs; thus a tumor lying behind the heart may press it against the thoracic wall or retraction of the margins of the lungs may expose an abnormally large surface.

A slowly lifting apex beat speaks with certainty for hypertrophy of the left ventricle (Friedrich Müller, Sahli). The location of the apex beat must be considered as well as the quality. Slight displacements may occur in individuals in perfect health and Krehl emphasizes that not too hasty conclusions should be drawn from abnormal location of the apex beat. In children in the first years of life the cardiac impulse usually lies in the fourth intercostal space in the mammillary line or perhaps 0.5 to 1 cm. without (Heubner). Also in puberty a slight displacement is of small significance since the apex impulse may later regain its normal position. Aside from these exceptions, a dislocation of the apex beat speaks for a displacement of the heart, and only when it is proved by percussion that the heart is in its normal place have we the right to explain the displacement of the apex beat by changes in the size of the heart.

Movable Heart.—Some clinicians, Leusser and Rumpf, diagnose movable heart whenever, in changes of position of the body, the apex beat is displaced. But as Bamberger and Gerhardt have shown, a slight degree of this displacement is certainly physiological. In adults in the left lateral position the displacement to the left amounts to 3.5 cm.; in the right lateral position, to 1.5 cm., to the right. Braun and Romberg also ascribe no importance to this condition. A. Pick, having examined a thousand individuals in regard to mobility of the heart on change of position, comes to the following conclusions:

1. A small amount of mobility occurs often, while a greater degree is relatively rare.

2. An abnormally movable heart in otherwise healthy individuals is to be considered as a congenital anomaly; on the other hand, its presence in cardiac defects or together with affections of other organs does not necessarily imply a genetic connection between this pathological process and the abnormal movability of the heart.

3. Abnormal mobility may be brought about by emaciation, whether due to disease or to a fat-reducing treatment.

4. The diagnosis of abnormally movable heart may be made with certainty on displacement of the apex beat and on the changes in the heart borders obtained on percussion.

5. Clinically, this condition sometimes causes no discomfort whatever, but in the greatest number of cases it is associated with occasional palpitation, feebleness, and dizziness on running or on forced movement; with incapability of lying on the left side, less often on the right, and with sensations of oppression.

According to Romberg, pleural adhesions and pulmonary emphysema are factors which decrease the movability of the heart; it is increased in changes of the ascending aorta, in chlorosis, and temporarily in delivery.

Sternal Pulsation.—If the heaving apex beat is of diagnostic value for hypertrophy of the left ventricle, the pulsation of the sternum enables us to recognize an hypertrophied right ventricle. The sternal pulsation, in which the heart is lifted with each systole, is a phenomenon which is best recognized by pressing the palm of the hand on the lower end of the sternum, the fingers in pronounced dorsal flexion. Pulsations in the third, fourth, and fifth intercostal spaces on the left side of the sternum correspond to an increased action of the right ventricle, but do not permit a diagnosis of hypertrophy. Epigastric pulsation has not much importance. It is found occasionally in entirely healthy individuals, no factors speaking for enlargement of the right ventricle, if the diaphragm stands low and the right ventricle assumes a more parietal position in the epigastrium. Sometimes it is not the right ventricle, but the abdominal aorta which leads to epigas-

tric pulsation; neurasthenics are especially prone to show this symptom, the throbbing in the pit of the stomach causing them much anxiety.

Other Pulsations on the Thorax.—Of great importance is the finding of a second pulsating center on the thorax independent of the heart. Occasionally a pulsation may be brought about by a tumor transmitting the pulsation of an underlying artery to the thoracic wall; in those cases where the palpating hand feels not only one simple stroke, but a diffuse vibration spreading in all directions during systole, the diagnosis of an aortic aneurysm is very probable. Only certain very vascular sarcomas show an almost independent pulsation. Auscultation, with consideration of all other factors which speak for aortic aneurysm, will clear up the matter in these cases. Sometimes, however, aneurysm may cause no symptoms at all and the fatal hemorrhage leaves to the pathologist only the possibility of making the diagnosis.

Systolic Retractions.—Sometimes we observe systolic retractions in the region of the apex, which result from adhesions of the pericardial layers. It would be entirely false from this symptom alone to diagnose pericardial synechia, since we see occasionally a retraction in cases which at autopsy do not show *concretio pericardii cum corde*. Too much significance must not be ascribed to those retractions which involve not only the region of the apex, but the intercostal spaces of the entire region of the heart. One sees at times, on entirely normal systolic impulse, retractions extending inward and upward from the apex of the heart; if under this condition the apex beat is absent, one may easily be misled. More importance must be attached to the systolic retraction in those cases, where after a healed pericarditis a systolic retraction appears in the place of the former heart impulse. Those retractions which involve the whole area of the heart are probably due to the diminution of the entire volume of the heart through systole; then the free intercostal space cannot be entirely filled by the lung, as, for instance, in shrinking and coalescence of the margins of the lung. v. Neusser emphasizes in his clinical lectures that retractions may occur in the anterior chest wall corresponding to the sulcus interventricularis, which are of no value for the diagnosis of pericardial synechia. There are still other symptoms, however, which aid in the diagnostic difficulties which we meet with in systolic retractions, namely, collapse of the cervical veins during diastole, noted first by Friedrich, and their swelling during inspiration, and the paradoxical pulse, which if also not pathognomonic is especially marked in indurated mediastinopericarditis.

Also, in the back, corresponding to the eleventh and twelfth ribs, a visible systolic retraction may be found occasionally, due to the action

of the diaphragm (Broadbent's sign); Alice Tallant found this symptom at times where a pericardial synechia was not present.

Determination of the Borders of the Heart.—In order to determine the borders of the heart, we may, beside percussion, make use of the radiological examination and of the friction sounds. The application of the results of these methods for the diagnosis of cardiac affections cannot be described here, but we wish to mention that in acute overexertion of the heart, the suddenly developed dilatation of the heart can be recognized by percussion. Allbutt states that during a strenuous mountain tour he was taken with a disagreeable sensation of epigastric pulsation, which returned at each attempt to continue the climb. On percussion it was possible to detect a considerable dilatation of the right ventricle, but a few minutes of rest were sufficient to allow a retrogression of symptoms to be observed. The determination of the heart borders is therefore not only essential for the diagnosis of a cardiac affection, but also serves as a control for the results of our treatment.

In the same way in the course of a pericarditis we may observe by percussion the increase or decrease of exudate, and the results are of prognostic and therapeutic importance, since a too great increase of exudate furnishes an indication for evacuation by puncture, provided that the general condition and the quality of the pulse permit.

Intensity of Heart Sounds.—The heart sounds may be diminished or increased in their intensity as a result of changes in the heart itself or owing to the influence of other conditions. These factors have always to be borne in mind if we wish to draw any conclusions from the change in intensity of the heart sounds.

Weakness of the heart sounds signifies in general cardiac weakness; thereby we have to exclude obstructions to the conduction of sound to the ear, as in very corpulent and muscular persons or in women with largely developed breasts, and in edema of the anterior chest wall. Other pathological processes which in reality have nothing to do with the production of the sounds themselves may influence these acoustic phenomena. The heart may be pushed back from the chest wall through emphysema or through pericardial effusion; this condition may lead to diminished heart sounds when no cardiac weakness exists. On the other hand, the lung may be shrunken and the heart become more superficial than normal. An increased superficial area of the heart is found occasionally in deformities of the thorax. Finally, the conditions of resonance also play a rôle, increasing the intensity of the cardiac sounds and giving them sometimes a metallic ring, as, for instance, in great distention of the stomach or if a large pulmonary cavity lies immediately on the heart or when air enters the pericardial or pleural cavity. If

infiltration exists in the portion of the lung bordering on the heart, the intensity of the heart sounds may be increased. The intensity is striking just in those cases where we should expect a low pressure, as in severe anemia; postmortem examinations show exceptionally thin and therefore easily vibrating valves which are the cause of this acoustic phenomenon.

Disregarding all these special conditions, the loudness of the cardiac sound furnishes quite a useful measure for the heart power, and variations in their intensity bear a certain relation to changes in the cardiac force. We see at the onset of every loss in compensation a diminution in the loudness of the sounds, and, on the other hand, if we succeed in removing the compensatory disturbance, the heart tones again become louder. In children the weakening of the second sound, after Heubner, of the first sound, after Czerny, is the first sign of a life threatening heart failure.

Intensity of the Various Heart Sounds.—Sometimes one heart sound alone shows a pathological variation in the intensity. To the thumping first sound as found in "frustrate" contraction of the heart attention was first called by Quincke and Hochhaus. By this we understand contractions interposed between entirely normal ones, which markedly increase the apex beat and the first sound, while the arterial pulse is strikingly weak. We have thereby probably to deal with incomplete contractions of the heart, often the first sign of failure of compensation. Some patients feel the frustrate contractions as a peculiar jerk or sudden pain.

The second sounds over the aorta and pulmonary artery are usually of equal intensity, as far as one may judge by the ear without the assistance of measuring instruments, though the blood pressure in the pulmonary artery is known to be much lower than in the aorta; this is compensated by the fact that the pulmonary artery lies nearer the thoracic wall. The relation of the two sounds may be disturbed by various pathological changes. The second aortic sound is increased if a hypertrophy of the left ventricle takes place, as, for instance, in chronic nephritis; also in higher degrees of arteriosclerosis accentuation of the second aortic sound is a regular finding.

The second pulmonic sound is accentuated in all those cases in which we find obstructed pulmonary circulation and a resulting hypertrophy of the right ventricle; as in lesions of the mitral valve and in chronic emphysema of the lungs.

It might be mentioned that even transient increase in pressure may lead to accentuation; thus, sometimes we hear an accentuation of the second aortic sound in the increased heart action of nervous palpitation. Under certain conditions the second pulmonic also may be temporarily accentuated, as in different abdominal affections,

perityphlitis, peritonitis, and even normally in the state of digestion.

Pendular Rhythm.—A knowledge of the pendular rhythm of the heart sounds is important. As the name suggests, the intervals between the heart sounds have in this condition become of equal duration, like the strokes of a pendulum; the otherwise normally existing difference becomes equalized through prolongation of the time of closure, and therefore this phenomenon is often observed in increased arterial pressure, as in the course of chronic nephritis.

Embryocardia.—If the pendular rhythm occurs, together with heightened frequency, the cardiac action resembles that of the fetus, and hence the name embryocardia. This is always a critical symptom, which in severe infectious diseases, as well as in heart diseases, indicates a considerable diminution in cardiac power. Especially in postdiphtheric affections of the heart, embryocardia often precedes the fatal collapse. The tick-tack heart therefore warns the physician to be doubly cautious and to support the heart energetically by means of excitants. Embryocardia of long duration is found in chronic diseases of the cardiac muscle, above all in myocarditis. Huchard gives a very unfavorable prognosis in cases in which it is heard for a long period.

Gallop Rhythm.—Another grave symptom is the gallop rhythm. It must be well differentiated from similar phenomena, since three tones may also be heard over the heart-in the reduplication of cardiac sounds. Perfectly healthy persons show sometimes a reduplication of the second sound especially in the height of inspiration (v. Leube). This phenomenon, which is likewise found in mitral lesions, has been explained by a difference in pressure in the great vessels, the semilunar valves at each orifice not closing at the same time; but it is more probable that the diastoles begin at a different time as a result of the unequal filling of the ventricles. During deep inspiration the suction of the blood into the right heart is increased and diastole relieved; at the same time the pulmonary vessels are dilated, and at first some blood remains in them which later at the height of inspiration is expelled with greater rapidity (Tigerstedt). In this way a diastole of the ventricles not entirely synchronous is brought about. Reduplication of the first sound may be sometimes observed through irregular contraction of the ventricles, a phenomenon of no special significance. Multiplication of heart sounds may arise not only from unequal action of both sides of the heart, but occasionally through the formation of a new tone. All these acoustic phenomena in general do not disturb the rhythm, the "two-four time" of the heart action is maintained.

Only the triple rhythm is of value for the diagnosis of cardiac weakness, and this only when heard over the entire heart. Only

at the apex or in the region of the left auricle the "three-four" rhythm may occasionally be heard in mitral stenosis, and is indeed so frequent in this lesion that in such cases one must make a closer examination. Moreover one hears the same phenomenon in dilatation of the left auricle and on insufficient aspiration of the left ventricle. The ventricle does not empty the auricle entirely during diastole, so that in the phase of entire relaxation blood still flows down from the auricle and sets the mitral valves in vibration (Wilson). The true gallop rhythm is to be heard over the entire heart; it consists of three sounds which are of equal value, of which the second is usually accentuated at the apex, the third at the base. Gallop rhythm is most frequently found in hypertrophy, as in the course of a contracted kidney. Further, in arteriosclerosis, emphysema, in valvular lesions with slight incompetency, in myocarditis and toxic injuries of the heart, especially in diphtheria; the value of this symptom, however, is not the same in all these diseases. Thus Krehl states that in diphtheria gallop rhythm is always a serious symptom, whereas it may exist for a long period and without special significance in chronic nephritis. Although it is accompanied usually with a low tension pulse and therefore taken as a sign of cardiac weakness, we often see it in chronic Bright's disease associated with a pulse of high tension. Its significance in diphtheria lies in the fact that it is often a forerunner of a postdiphtheric paralysis of the heart, and that it may be observed even before the increased frequency of the pulse. However, it must be mentioned that Oswald Vierordt has found gallop rhythm in entirely healthy persons in a phase of excited cardiac action.

As for the explanation of gallop rhythm the cardiograms of Kriege and Schmall seem to show that the new additional tone is a muscle sound of the left ventricle which may be heard very early, since certainly between the action of auricle and ventricle a considerable interval exists. The true nature, however, of the disturbance, the retardation in this phase of the heart action, is at present still beyond our knowledge. Some consider the asynchronous contractions of the ventricle to be the cause of this rhythm, while others consider it a jerking contraction of the ventricle.

Heart Murmurs.—The murmur is by no means pathognomonic for the existence of organic heart disease and no conclusions can be drawn from its intensity as to the severity of the condition of the valves. It is known that the severest forms of mitral stenosis may exist without any murmur, while, on the other hand, accidental murmurs may be found of great intensity usually on systole. Doubtless diastolic murmurs also occur without any anatomical changes, but this is certainly the exception. We consider a murmur as a functional one when no abnormal accentuation of the heart sounds over

the great vessels speaks for hypertrophy and when percussion gives no evidence of dilatation of any part of the heart. In diastolic murmurs one must be cautious in pronouncing them accidental murmurs; still in anemic persons, as Sahli emphasizes, we find venous murmurs ("Nonnensausen") which, transmitted to the heart region, give the impression of diastolic murmurs. A diastolic murmur occurring at the ensiform process, especially in connection with a duplication of the first sound, announces a beginning cardiac weakness.

In general, then, we may expect accidental murmurs if the ventricle contracts with increased velocity in order to compensate for the faulty composition of the blood. Cohnheim has shown that an artificially produced hydremia increases the rapidity of the blood stream. The anemic murmurs in fever also probably have their origin in accelerated circulation. If on blood examination we find a low hemoglobin content, it is at first not clear whether we have to deal with a constitutional diminution of hemoglobin or whether the organism feels this decrease of hemoglobin as pathological (functional chloranemia); in the latter case it reacts with an effort at compensation, *i.e.*, with increased rapidity of circulation. Following this idea of Sahli, we may conclude from the presence of venous hum that the poverty in hemoglobin is pathological and therefore capable of improvement.

Krehl, on the other hand, doubts that the blood stream has an increased velocity in anemia and in other ailments, and that the experiment of Th. Weber avails in these conditions, namely, that a liquid streaming in a system of tubes produces sound phenomena if the velocity is increased.

Relative insufficiency produced by dilatation of the heart in the region of the orifice and by the insufficient action of the papillary muscles certainly plays an important part in accidental murmurs. We are scarcely justified in ascribing systolic murmurs of the heart which disappear again to a dilatation of the beginning aorta and therefore to a relative insufficiency of the semilunar valves, since we hear systolic murmurs either at the apex or above the pulmonary artery, scarcely ever over the aorta.

Accidental Murmurs in Children.—One often finds also in children long systolic murmurs at the point of origin of the great vessels. Heubner could, in these cases, on postmortem examination find neither organic heart lesions nor changes in the pericardium, as, for instance, milk spots, whose presence would be very improbable anyway considering the youthful age of the patient.

Hochsinger and others deny that accidental murmurs occur in the first three years of life. Rheiner, on the other hand, even in the first year of life, has found murmurs over the pulmonary artery and mitral

valve for which, at autopsy, he was not able to account. According to Heubner, anemic murmurs in the so-called school anemia are not rare, and he gave two factors in their differential diagnosis from organic murmurs: 1. In such cases there is present a marked venous hum or, at least a systolic blowing in the great arteries of the neck. 2. Organic heart murmurs become more distinct in a lying position, whereas the anemic murmurs become weaker.

Objective Functional Examination.—It is known that the objective examination, as above described, is often not in accordance with the anamnestic data given by the patient. Patients complain of compression, dyspnea, and palpitation on bodily exertion, although on objective examination we are unable to find any cause. A test for functional capacity would be here of the very greatest value, but such a method by examination presupposes a sufficient number of standard values. One must cause a great number of normal individuals to do an equal amount of work and observe the changes in the pulse in regard to frequency and rhythm, as well as the filling and tension of the arteries. The patient's manner of life and, above all, the influence of earlier training have of course to be taken into consideration. For the examination of gastrointestinal disorders we have in the test-meal a method of determining standard values and pathological deviations from the normal. Then we must establish uniformity in examination of the functional capacity of the heart. A. Pick had occasion to examine a great number of individuals in this regard under similar conditions—young men during their service in the army. The functional examination of the heart action in bedridden patients consists in having them sit up several times; in lighter cases, in having them pace a short specified distance, for instance, three times the length of the sick-room. Immediately after this performance, the quality of the pulse and the blood pressure are examined, whereby data are obtained for estimating the functional capacity of the heart. Very suitable for such examinations is Gärtner's ergostat.

Krehl calls attention to the fact that patients with changes of the heart muscle or in the valvular apparatus possess a more labile heart-frequency. In such individuals arrhythmia is easily brought about on muscular exertion, whereas in healthy individuals in general the pulse acceleration of exertion remains within certain bounds, and shows even greater regularity than during rest. Sometimes in well compensated heart lesions the increase of pulse frequency following changes in the position of the body is less than in persons with healthy hearts (hypercompensation, W. Winternitz).

Very slow flexion and extension of the forearm (self-inhibition) leaves the pulse unchanged or slightly accelerated, while in affected heart muscle bradycardia results (Hertz).

Also in estimating the blood pressure Rieger finds a difference between healthy people and those suffering from heart disease; in the first the blood pressure rises following exertion, in the latter it is unchanged or even sinks.

As another measure for cardiac power one may employ the energy and rapidity with which the heart recovers itself after specified work (Gräupner).

Subjective Heart Complaints: *Heart Pains, Precordial Anxiety, Dyspnea, Angina Pectoris.*—As to the subjective complaints, we find, first, pains in the region of the heart, a peculiar feeling of cardiac anxiety, also called precordial anxiety, a feeling of dyspnea and oppression; further, a peculiar agonizing sensation of pain not to be more closely defined, or mortal agony and annihilation called angina pectoris, and finally the perception of the cardiac action itself.

The disorders of the respiratory tract from which persons with heart disease usually suffer will be discussed more in detail in the chapter on Dyspnea; and the attacks of stenocardia will also be considered further, since this symptom-complex merits a prominent place in our book from its great danger to life. There remains still for discussion here cardiac pain, precordial anxiety, and palpitation.

Pricking pain in the region of the heart and the feeling of anxiety are found more or less pronounced in most diseases of the heart; in endocarditis, as well as in affections of the heart muscle and of the pericardium. Cardiac lesions, in the state of compensation, very often show not the least discomfort. In general the rule holds, as Nothnagel emphasizes that especially diseases of the cardiac muscle, of the coronary arteries, and of the aortic orifice are associated with pain, while mitral lesions generally produce pain rarely. In congenital heart lesions we hear complaints occasionally of pain in the heart region and of feelings of fear; these two symptoms, however, need not run parallel, sometimes the pain predominating, at others the precordial anxiety. Since fear may lead to disturbances of the heart action, and these again are associated with feelings of fear, it is, therefore, not easy to decide which is the primary factor. Some patients, observing themselves very well, confess that they sometimes waken at night suddenly with feelings of anxiety, but without consciousness of any disorder on the part of the heart, such as arrhythmia, stopping, or suffocation. We must, however, admit that in patients with arteriosclerosis we are sometimes too easily inclined to ascribe to the heart sensations of anxiety which have nothing to do with it, as for example, those of purely pyschic origin in neurasthenics. In many cases a gradual change takes place from precordial anxiety and cardiac pain, to cardiac asthenia and angina pectoris; these sensations which may be considered as *formes frustes* are much more common than the well-

pronounced forms which we designate by certain names. Krehl holds to this conception which was already taught by Laennec. In all these attacks we find the cardiac action somewhat disturbed, the pulse is small, easily compressible, often arrhythmic, usually accelerated, in a few rare cases, however, retarded. Occasionally, though somewhat rarely, loss of consciousness may occur during an attack, and O. Vierordt emphasizes rightly that the serious condition of stenocardia may be hidden by the symptoms of syncope, which is of itself of little importance.

Palpitation.—The healthy individual has usually no consciousness of the action of his heart: he notices it only when it is greatly increased through muscular exertion.

Even in pathological changes of the heart action, as in bradycardia, there often exists no sensations pointing to these anomalies of the heart; indeed one often finds severe disorders in which the patients do not complain at all of trouble on the part of the heart, at the most mentioning dyspnea on going upstairs or digestive disturbances. Occasionally, it is true, a patient feels clearly the interruption to the heart action. In other cases we hear complaints about vibrations of the heart (Herzflimmern) and, in accordance with this, we find, objectively, very superficial heart contractions following each other in quick succession. The perception of the heart action is frequently associated with pain and anxiety.

In some children the sensation of increased heart action announces itself quite early as an uneasiness; when the little patients are still unable to give expression to this sensation, the mothers state that they have been able to observe the increased cardiac action and the discomfort of the child. If the children have reached the school age they often complain of palpitation, it may be they suffer from acquired or congenital heart lesions, or also from attacks of increased heart action not uncommon in school anemia.

If we examine a patient during an attack of palpitation we find the apex beat heaving, the cardiac action accelerated or retarded, sometimes also arrhythmic. The pulse may be large or small, hard or soft, according to whether the heart has time to become filled sufficiently during diastole or not; the sounds at the base are generally accentuated.

In general, the patients only complain of palpitation when the reserve power of the heart is already exhausted. As long as the heart has sufficient reserve power and works with increased force in order to meet the increased demand, no subjective disturbances exist. We see enormous dilatation and hypertrophy in compensated valvular lesions without the patients' complaining. As soon as failure of compensation threatens, palpitation occurs; therefore palpitation,

neurasthenia excluded, is a warning to the physician to decrease as much as possible the demands on the heart.

We see the same symptoms in acute overdistention of the heart. Here also palpitation indicates that further overexertion may lead to the most serious disorders. One finds palpitation quite often in the so-called fatty heart or, better expressed, in the heart disturbances of fat persons. As Krehl explains, in these plethoric individuals the too rapid flow of too large quantities of blood to the deficient heart may, on great muscular exertion, produce disturbances, since the heart, which in fatty persons, especially in more advanced age, has suffered in its efficiency usually from other diseases, as arteriosclerosis, coronary sclerosis, changes in the kidney or chronic myocarditis, is not able to meet these increased demands upon it.

PERIPHERAL SYMPTOMS

Arteries.—For diagnosis of arteriosclerosis we must refer to the remarks under Pulse Examination. Beside the radial artery, one will have to examine carefully also the temporal artery, the carotid, the subclavian, the crural, popliteal, and dorsalis pedis, and will try to gain information concerning the high tension of the blood pressure as well as the rigidity of the vessel wall. The tortuous course of the vessel is sometimes dependent on the increased blood pressure, especially in those cases in which the vessel wall is particularly yielding.

Examination of the peripheral vessels plays an important part in the diagnosis of aortic regurgitation, examination of the lower extremities in the diagnosis of intermittent claudication, described by Charcot and Erb. In the latter affection the arteriosclerotic vessels of the lower extremities are still sufficient to nourish the muscle in the state of rest, but when the patient tries to walk for any length of time, he fatigues very soon, paresthesias or, indeed, very pronounced pain appear in the legs, and so he is very soon forced to limp and to stop his movements. According to Charcot, if the lumen of the vessel is narrowed to a high degree, this affection leads to senile gangrene. In such cases one must ascertain to what degree the pulse of the vessels of the lower extremities is still perceptible, by palpation of the posterior tibial artery behind the internal malleolus and of the dorsalis pedis in the first interosseal space.

In recent times Moszkowicz has made it possible to study the circulatory condition in these conditions more accurately through his hyperemia test (see Anomalies of the Skin).

Congenital Narrowing of Aortic System.—General narrowing of the aortic system may be congenital; its morbid anatomy has been

studied principally by Virchow and Rokitansky. In some cases the heart takes part in the general hypoplasia and remains small; in others it hypertrophies in order to overcome the resistance in the greater circulation.

Formerly hypoplasia of the vascular system was considered the cause of chlorosis, hemophilia, and of hemorrhagic diseases in general, but at present the idea of a causal connection is abandoned. The patients show sometimes a peculiar paleness of the skin, a certain degree of cyanosis, and in some cases dropsical manifestations; the peripheral arteries are strikingly narrow, the frequency of the pulse rather high. The affection is more common in females than in males, and in girls one finds it associated not seldom with a defective development of the sexual organs, a fact which led to the belief of its connection with chlorosis. The patients in the first decade of life generally are unable to fulfil the demands which their life has made on a healthy heart. H. Vierordt is of the opinion that this condition could be much improved if the patient would be considered from the beginning as a subject of heart disease and would live accordingly. Still the cause of this condition is not sufficiently known and appreciated.

Veins.—Generally speaking, swelling of the veins indicates weakness of the right ventricle; however, it must be emphasized that there exist certain individual differences and that one should not be too hasty in concluding weakness of the right heart from swollen veins. Distended veins, without insufficiency of the right ventricle, are seen in persons in whom there is great obstruction to the venous flow. Marked venous dilatation may be seen not only in emphysematous patients, in whom the functional deficiency of the right ventricle can never be entirely excluded, but also in patients suffering from pertussis. This symptom together with the peculiar puffy aspect of a pertussis patient allows us to make a probable diagnosis even in the interval between attacks. Each attack of cough is followed by a high degree of venous stasis, and in this way the veins gradually become dilated.

Manifestation in the Cervical Veins.—In cardiac stasis, swellings are observed in the external jugular veins; these, however, may only be diagnosed if they are very marked, since this vein shows great differences in development. If the engorgement of the heart is pronounced, the respiratory fluctuations are markedly expressed in the veins, the vessels swelling on expiration and collapsing on inspiration. At the same time there commonly exists a so-called negative venous pulse; that is, a venous collapse during diastole of the auricle or systole of the ventricle; it may be sometimes detected even in healthy people, but is especially marked in cardiac engorgement.

On the other hand, there is a positive venous pulse in which the

greatest swelling of the cervical veins coincides with the ventricular systole. If this symptom is seen with certainty, one is justified in diagnosing a tricuspid regurgitation, eventually a mitral regurgitation with open foramen ovale; still it is sometimes quite difficult to distinguish the positive venous pulse from the pulsation transmitted from the carotid. In such cases one may try to push the vein away from the artery and observe the pulsations or one may endeavor to compress the vein with the edge of the pleximeter. Normally, in this case the proximal portion will collapse and the distal portion swell; if however, the vein receives blood not only from the periphery but also from the auricle, as is the case in positive venous pulsations, a filling and pulsation of the proximal portion may be observed.

The ventricular diastolic venous collapse should not be confused with the ventricular systolic venous pulsation, the former, on first glance, leading to the same changes in the state of filling of the veins as the latter. Friedreich was the first to call attention to the fact that in concretio pericardii cum corde the chest wall, during diastole, assumes its former position, and thus aspiration leads to a rapid emptying of the cervical veins.

All these manifestations of stasis in the cervical veins presuppose an insufficiency of the valves of the veins. This seems to be the case in almost any stasis.

G. Gärtner uses the decrease of swelling of the veins on the back of the hand in lateral elevation of the arm to determine the pressure in the right ventricle. At the moment when the vein collapses the difference in height between the back of the hand and the upper border of the fifth rib at the sternum gives the blood pressure in terms of a column of water. Romberg believes that the tonus of the venous wall makes this method unreliable.

Cyanosis.—An important symptom of circulatory disturbance is cyanosis. There may be two factors in producing general cyanosis:

1. The deficient absorption of oxygen by the blood in the lungs as well as deficient exhalation of carbonic acid gas. In this case the blood returns laden with carbon dioxid and insufficiently arterialized to the tissues, where it soon becomes entirely venous.

2. Stasis, producing retardation of the stream in the capillaries, the blood thereby being deprived almost entirely of its oxygen and being laden with carbon dioxid. In general the rule holds that in respiratory diseases dyspnea is more pronounced than cyanosis, while in circulatory disturbances the contrary condition is to be observed (v. Neusser). It must be remembered that the venous blood contains constantly a larger or smaller amount of oxyhemoglobin.

Symptomatology.—The deoxidation of the blood takes place equally throughout the entire body. Cyanosis, however, is not developed to the same degree everywhere, but is much more pronounced in the periphery than, for instance, on the skin of the trunk. Cyanosis may be easily recognized on the tip of the nose, the ears, the cheeks, the lips, and the visible mucous membranes in general; on the feet, especially in the toes, and in the terminal phalanges of the fingers. The discoloration of the nail bed is an especially constant sign of cyanosis. Sahli calls attention to the fact that in many cases cyanosis is well pronounced in the knees.

Dilatation of the great veins and cyanosis do not always run parallel. In congenital heart failure the great veins often are not much dilated, the blood being generally congested in the small vessels, producing a high degree of cyanosis. The case may be just the reverse in uncompensated acquired lesions, in which the great veins receive the greatest part of the engorged blood, thereby decreasing cyanosis (v. Neusser).

If we exclude all those diseases which prevent the entrance of oxygen into the blood in the lungs, as all forms of stenosis of the air-passages, diminution of the respiratory surface of the lung, and all diseases of the respiratory muscles, there still remain, above all, valvular lesions, affections of the cardiac muscle, pericarditis, arteriosclerosis, and all those diseases which lead to secondary involvement of the heart, as nephritis. If we disregard congenital heart lesions it is, above all, disease of the mitral valves which produce cyanosis. Aortic lesions produce paleness rather than cyanosis as long as the right heart functionates. A certain degree of cyanosis may exist not only in loss of compensation, but also in entirely compensated lesions of the mitral valve; since also in the latter case an increased pressure exists in the pulmonary circulation, causing the condition of *"congestion and induration" of the lungs* (v. Basch), in which respiratory expansion is diminished. We see that this form of cyanosis in mitral lesions is not to be explained through stasis, but through deficient arterialization (Sahli).

Cyanosis in Congenital Heart Lesions.—Cyanosis in congenital heart lesions is of particular importance; it is especially so in the first years of life, when at first glance the diagnosis may be made. Sometimes the children are so dark that they have been compared to a mulatto, hence in exceptional cases the term "blue baby." Still, large defects in the septum may exist without any marked cyanosis (v. Neusser). It is found regularly in extreme pulmonary stenosis and in congenital tricuspid lesions. The explanation of cyanosis in congenital heart lesions is at present not free from objections. There is certainly disproportion between cyanosis and dropsy. If a patient with ac-

quired heart disease shows as high a degree of cyanosis as we are accustomed to see in morbus cœruleus, more or less pronounced symptoms of dropsy are at the same time present. Thus the cyanosis of congenital heart lesions is not to be explained entirely through stasis. Variot emphasizes that in malformations of the heart, anatomically identical, extreme cyanosis or even no cyanosis may exist. Indeed not rarely one sees that a child becomes blue only on loud screaming, coughing, or vomiting, or that at least some muscular exertion, as bending, is necessary to produce the characteristic discoloration, though the examination of the heart, as well as the postmortem findings, show a congenital heart lesion.

Cyanosis from Mixture of Arterial and Venous Blood.—One has also endeavored to make changes in the lungs, as well as the enrichment of stagnant blood in red blood-corpuscles, responsible for cyanosis. None of these explanations, however, appear valid (H. Vierordt). In certain cases "mixed cyanosis," namely the mixture of arterial and venous blood, seems to be the most plausible explanation. Yet it must be admitted that one may find large or small defects in the septum of the ventricles or of the auricles, unaccompanied during life by a severe grade of cyanosis. This is easily understood, for the blood does not pass from one ventricle into the other, as long as no marked difference of pressure exists between the two ventricles. But in those cases where, through complications with valvular lesions, great pressure differences develop in both ventricles, such a passage is conceivable—above all, when the aorta receives its blood from both sides of the heart, its point of departure being directly over the defect in the septum. In this case, sometimes associated with congenital pulmonary stenosis, the aorta certainly receives also venous blood. We shall always have to think of mixed cyanosis in those cases where a marked cyanosis of the skin exists, but no signs of severe stasis, as dilatation of the veins or dropsy.

Cyanosis in burns of the skin is the result of thrombosis of the vessels or of a toxic effect on the heart. We find an analogy for the latter conception in fish poisoning and intoxication with snake venom. In a similar way the cyanosis in intestinal anthrax (v. Neusser) and in other infections may be explained. Finally, among the poisons, laughing gas leads to severe cyanosis.

Local Cyanosis.—We must still mention briefly the local cyanosis which exists in healthy individuals, under the influence of cold, and, in hysterical persons, occasionally associated with edema (œdeme bleu des hysteriques). Pressure on the veins from tumors or thrombosis may cause cyanosis in the root region of the vein.

Anilin (antifebrin) and nitrobenzol intoxications are followed by a peculiar gray-blue discoloration of the skin; this however, is no true

cyanosis, but is caused by the transformation of the blood into methemoglobin. Also in potassium chlorate poisoning, methemoglobin is formed in the blood, the patients showing a marked cyanotic aspect and at the same time a slight yellowish tint.

Finally, the autotoxic enterogenous cyanosis of Stockvis and Talma may be mentioned, in which enteritic symptoms, clubbed fingers, and methemoglobinuria are associated with severe cyanosis of the skin and of the mucous membranes. Perhaps we have sometimes to deal with sulphemoglobinuria instead of methemoglobinuria. This symptom-complex may be caused by congenital stenosis of the rectum.

There are diseases in which cyanosis is rare, as in all instances when the formation of blood has severely suffered, *e.g.*, chronic Bright's disease. If the hematopoiesis is normal, a nephritic edema may appear blue and the differential diagnosis between cor renale and ren cardiacum becomes very difficult.

Peripheral Frigidity.—As a result of the slowing of the blood current the peripheral cyanotic parts are usually cool and the difference between the internal temperature of the body and that of the periphery may be to a certain degree a measure of the cardiac weakness, as in Asiatic cholera, where, in the algid state, this difference in general goes parallel with the severity of the case. Sometimes not only the external, but also the internal temperature is lowered; thus in congenital heart disease subnormal temperatures, occasionally even under 36° C. in the rectum and still lower, are commonly registered. Whether the total decomposition is actually lessened, the body cells adapting themselves to a greater economy in accordance with a decreased supply of oxygen, is not finally decided. v. Noorden expresses himself in the following way: "In spite of the slowing of the circulation, the quantity of the oxygen supplied and of the oxygen consumed may retain its normal relation. It does not follow that this condition is indifferent to the tissues, for on account of the low pressure of the oxygen in the capillaries the cells have an increasing difficulty in gaining oxygen. On longer duration, however, they may overcome this difficulty only with injury to their development and to their metabolism." To disorders of this kind he ascribes the backwardness in the general development of the body, which patients show who have suffered from circulatory diseases from their early youth. The body temperature, in subjects of cardiac weakness, is generally subnormal, and very trivial disturbances may drive it to a great height; it is therefore more labile in its changes than that of healthy individuals. The same may be observed in children with congenital heart failure.

Clubbed Fingers.—In patients who suffer from chronic cyanosis one usually observes changes also in the growth of the skin at the ends

of the fingers and toes. In well-developed cases swelling of the bones of the terminal phalanges occurs. The nails show a peculiar hook-like curvature upward. These changes are oftenest seen in bronchiectasis and in empyema of long standing, more rarely in the course of chronic phthisis. They occur also in congenital heart lesions, and in diseases associated with intoxications, as chronic icterus (Obermayer). A great number of "empyema fingers" results less often from cyanosis than from the resorption of decomposition products. Significant for us is the fact that from stasis which has existed for months, or even for weeks, clubbed fingers have resulted, and that when the cause of this stasis was removed these changes have shown themselves entirely capable of retrogression.

Dropsy: Urine of Congestion.—Dropsy, one of the most frequent sequelæ of disturbed circulation, known even to the laity, will be treated in a special chapter as will also the changes which the urinary secretion undergoes. It is characteristic of heart weakness that at night patients pass more urine than during the daytime when the arterial pressure is too low (Nycturia).

SYMPTOMATOLOGY OF HEART WEAKNESS

Acute Course.—We shall now return to the clinical picture of heart weakness. This is a symptom-complex which presents itself in various forms, according to the intensity and duration of the symptoms. Sometimes one sees a sudden failure of the heart action. Consciousness is lost at once or the patients have still time to express feelings of mortal agony, by the features or by a few words: the face is pallid, the pulse no longer palpable in the radial artery; the heart sounds become dull and soft, often entirely irregular; occasionally convulsions and grimaces precede death. In certain cases one may see the re-establishment of the heart action which was believed to be lost; and it is still an unsettled question how long the heart action may cease before its functional capacity is definitely lost. Experimentally, especially in children in the first year, it has been possible to obtain contractions in a heart absolutely rigid by means of Ringer's salt solution, twenty-hours after death. In any case it certainly is one's duty to attempt reanimation in cases where only a few minutes have elapsed since the last heart beat.

Subacute Course.—This process, ending in a few seconds, may run a somewhat more protracted course, it may, but not with such intensity, last even a long time, and become chronic. When symptoms of heart failure exist for hours we are accustomed to speak of collapse of the heart, and the chronic condition may drag on for months or years under the different forms of insufficiency of the heart muscle.

Chronic Course.—The picture of chronic cardiac weakness develops gradually. The complaint is not always described by patients in the same manner. One speaks of palpitation, another of the feeling of oppression or of outbreaks of severe sweat on the slightest exertion, others complain of digestive troubles, of loss of appetite, of the sensation of fulness in the abdomen after eating, of pressure in the stomach, and of pain in the right hypochondrium, which is due in general to the increased tension of the capsule of the liver on swelling from congestion. The quantity of urine is decreased, the specific gravity is high, and the legs show signs of edema. This swelling generally disappears at night, especially on the ankles, and reappears again during the day; in more severe cases it remains continuously associated with cyanosis and with congestion and pulsation of the veins of the neck. The patients suffer further from severe dyspnea and often from bronchitis; a tenacious mucus is expectorated, sometimes, on account of the stasis, mixed with fresh or transformed blood. On microscopical examination, heart-disease cells are found in large quantities. Dyspnea may suddenly increase considerably, either from acute failure of the heart power or from a small embolus in the lung. Occasionally dyspnea attains the highest degree; the patients are obliged to assume an upright position for several days, until the intoxication with carbon dioxid renders the sensorium insensible and brings an end to their suffering. Sometimes death occurs suddenly, through syncope of the heart, through embolic processes in the brain or in the lungs, sometimes also from an apoplectic attack. Again, in a number of cases an intercurrent pneumonia or an erysipelas develops; to the latter, patients with edema are especially susceptible. In rare cases embolism of the mesenteric artery occurs, announcing itself by sudden violent pain and profuse intestinal hemorrhage followed in a few hours by exitus lethalis.

The picture of the primary disease which has led to the cardiac insufficiency is generally somewhat obscure. In the heart itself the apex beat disappears or becomes diffuse, the chest heaves and trembles over the entire region of the heart, the pulse is generally accelerated, sometimes retarded, irregular, and unequal, occasionally allorrhythmia is to be observed, but in any case the tension of the pulse and the filling of the arteries show constantly a marked decrease. The heart dulness is markedly increased to the right or to the left or both. If mitral or aortic regurgitation is present at the same time, it may reach the highest degree. The right border of dulness is very labile. It may increase or diminish according to the condition of the patient, and, therefore, the right border of the heart dulness is quite important for the immediate prognosis. An extension to the right signifies a change for the worse; a receding of the border, an improvement.

Murmurs may appear and again disappear or change their character, so that in a patient whom we see for the first time in a state of cardiac weakness an exact diagnosis of the primary disease is almost impossible. Only one affection of the heart is recognizable constantly to the terminus, namely, aortic regurgitation.

Prognosis.—In regard to the prognosis in heart disease, in general one may regard a heart lesion as the more severe the greater the hypertrophy that was necessary in order to overcome the obstacle to circulation; and a marked hypertrophy has therefore to be considered as prognostically unfavorable even if of itself it must be regarded as a life-preserving, compensatory process. The presence of dilatation naturally renders the prognosis more unfavorable. In judging compensatory disorders, long experience teaches us that mitral regurgitation relatively early and frequently leads to compensatory disturbances, which, however, if properly treated, often give way to a feeling of entire well being lasting for some time. Aortic lesions, on the other hand, may exist for years without giving any symptoms, and only late give rise to compensatory disturbances, since the left ventricle has far greater capacity to hypertrophy, and in this way to remove hindrances to circulation, than the weaker right ventricle, upon which compensation of the mitral lesion is incumbent. If, in an aortic lesion, failure of compensation has once appeared, the whole auxilliary apparatus has been set in action and therefore the prognosis of this failure of compensation is much more unfavorable.

Nervous Heart Affections.—A symptom-complex, which to a certain degree resembles the picture of organic heart disease with cardiac weakness, is met with quite frequently in neurasthenic individuals. With many neurasthenics the heart and vascular system are the chief point of complaint and apprehension. They are constantly in fear of dying from heart stroke. In general, as Rosenbach states, it will happen much oftener that one considers an organic heart affection as a functional one than that one mistakes a functional disease for an anatomical process. The disease in question is best designated as vasomotor neurasthenia of the heart, identical with the irritable heart and with the starvation of Fothergill. This condition is found especially in men, sometimes even at the age of puberty. Physical or mental overexertion, deficient nourishment, and sleeplessness, together with abuse of alcohol, tea, coffee, and tobacco may be responsible for it. Occasionally several factors work together, as during the preparation period for examinations. In some cases sexual life plays a rôle, interrupted coitus, masturbation, or sexual abstinence; in others slight exertion in the convalescent stage following acute infectious diseases has to account for it, and it is therefore advisable in convalescence from severe infectious diseases, as for instance,

diphtheria, to remain in bed for a long time and to return to the usual mode of life only gradually. Sometimes the malady follows an anemia or a psychosis (melancholia).

In this condition a state of hyperesthesia and one of depression may be distinguished. In the first stage the patients complain of cold hands and feet; one observes in them rapid changes from redness to paleness; they feel a sudden rush of blood to the head, sometimes the sensation of precordial anxiety, of oppression, and of heart tremor, and sometimes a marked sensitiveness to touch is observed over the region of the heart. The cervical arteries and the abdominal aorta show strong pulsation, the patients complain of severe palpitation, but no increased action of the heart can be detected; the appetite is poor, constipation is present, sometimes also chronic sleeplessness. The heart action is often increased, the frequency of the pulse paroxysmally or constantly heightened; the tension of the arteries is good, except in attacks of precordial anxiety where, probably through the frequent action of the heart, the filling of the ventricles is deficient.

Gradually the second stage, that of depression, comes on. The nutrition of the patient suffers, and anemia occurs as a result of the loss of appetite and sleeplessness; the heart action becomes weaker as the strength of the whole musculature fails; in spite of this, the patients feel an increased heart action and complain of palpitation. The pulse is generally accelerated, although in these cases one is scarcely in the position to make a careful examination; still a grasp of the wrist is usually sufficient to prove a condition of excitement, and the patient himself, accustomed to feel his pulse, will confirm this finding of increased frequency. No real symptoms of stasis are present, however, neither cyanosis nor dropsy. Slight edema over the ankles and along the tibia is seen, as well as swelling of the lower lids, but this may occur also in exhaustion (Rosenbach). There exists a peculiar paleness and a tendency to headaches and vertigo, and even to syncope.

In making the diagnosis one will have to exclude, first of all, weakened heart, then sclerosis of the coronary vessels, and the different troubles leading to insufficiency of the heart. Neither dilatation nor hypertrophy is present and the paresthesias do not affect the left upper extremity only, but, if present at all, affect both extremities equally, a fact which speaks against coronary angina; but the patients are also too young to have a sclerosis of the coronary arteries. The absence of edema and the urinary findings speak against muscular insufficiency from whatever cause; the urine is abundant and never shows a specific gravity above the normal; the liver lies within its normal boundaries and is not tender; rest or movement apparently has no influence on this condition, and for this reason the symptoms are not, as is usually the case in organic heart disease, most pronounced

toward evening, but, on the contrary, in the morning; usually the patients complain especially before they have taken food. In functional diseases of the heart dyspnea is not present.

TREATMENT OF CARDIAC DISEASES IN GENERAL

In the treatment of heart affections, certain general therapeutic measures are indicated, irrespective of the nature of the primary disease. These will now be discussed. We shall also consider special indications. In treating heart disturbances of every kind we have first to consider the question whether or not circulatory disturbances have arisen which have led to changes in the distribution of blood (Krehl). If these are present we have first to direct our attention to their amelioration, and we shall consider extensively the measures which are at our disposal. In those cases in which circulatory disturbances are not detected they should be combated prophylactically.

I. Compensated Heart Lesions

Compensated heart lesions may serve as an example. In compensated heart lesions, regulation of the entire mode of life is the chief point in the treatment. The patient will be allowed activity in any line only to such a degree as is compatible with the working capacity of his heart. This should begin with the affairs of everyday life. He needs much sleep, should abstain from excesses in eating and drinking, and should practise great moderation in the use of tea, coffee, alcohol, and tobacco. But the taking of food at long intervals, and therefore in great quantities, is not wholesome for these patients. The gastrointestinal tract becomes thereby inflated with gas, and an extensive digestive hyperemia of the abdominal organs arises. The result is often seen in the condition of the patient who, after an abundant meal, complains of oppressive sensations. It is of advantage for patients with heart trouble to rest after meals. Ortner states that the abdominal vascular system has space for two-thirds of the total quantity of blood, and therefore if muscular exertion is made after a meal during digestive hyperemia, the whole quantity of blood stored in this great reservoir rushes suddenly to the peripheral musculature, resulting certainly in a very sudden demand upon the power of the heart. On the other hand, it is advisable to have these patients take moderate exercise, but at the same time to estimate with care their power to do muscular work and to allow them to increase their work gradually only if they have endured slight labor without any discomfort, as palpitation, dyspnea, or headaches. If Oertel's treatment (exercise on chosen ground) is not feasible, one may, in special cases,

accomplish much through medical gymnastics and Zander's machine gymnastics.

The effect of respiratory gymnastics on the heart is very favorable. The rapidity of the current of the circulation thereby becomes constantly increased, the blood pressure in the periphery falls, and the resistance for the heart is diminished. At the same time the heart is better supplied with blood through the advancement of the venous circulation; it receives thus a stimulus to increased muscular action; and a better filling with blood, together with increased function, brings about the hypertrophy which is to be desired in the interest of compensation. For this reason, deep respiration which is required in places of high altitude to cover the want of oxygen, is certainly of advantage in well-compensated heart lesions. The highest altitudes, however, are certainly not to be recommended to patients with cardiac ailments. We should select rather places of medium elevation, of about 1000 meters. However, in cases of aortic insufficiency, high altitudes are not indicated.

Oertel's Treatment.—Oertel's views on the treatment of cardiac lesions may be mentioned here. He proceeds with the idea that through restriction of the supply of liquids the quantity of blood is diminished and thus also the mass which the heart must force through the body. He ascribes the favorable results which are in fact observed when the fluids are restricted, to the decreased demands on the cardiac power. Zuntz, on the other hand, believes that the concentrated blood possesses a greater number of oxygen carriers for each unit of space, and that, in consequence, the heart is better fed, though the quantity of blood remains the same.

Supply of Fluid.—However this may be, it is advisable to restrict the liquids as much as possible in cardiac diseases and especially to forbid the use of beer. This is much more injurious than wine, since, aside from the alcohol, it causes, though only temporarily, much greater demands on the heart through its great quantity of fluid; also the carbon dioxid contained in beer is pernicious, leading to meteorism and deficient respiration and the resulting deleterious sequelæ. For the same reason charged waters and champagne must be eliminated.

Balneo-therapy.—In the treatment of compensated heart lesions the bath treatment plays a great part at present. It must be mentioned, in the first place, that too cold as well as too warm baths are not tolerated by heart patients; it is necessary, therefore, to choose an indifferent temperature at which the vessels of the skin are neither too suddenly dilated nor constricted. Baths of 31° to 35° C. may be recommended, with perhaps the addition of salt (1 per cent.) or carbon dioxid. At this temperature, neither accumulation of heat nor loss of heat with the following increased production takes place, but the loss of heat and

thereby the heat production are limited and the heart spared. The custom of taking a cold shower following a warm bath in order to bring about contraction of the dilated vessels of the skin is, for the above-mentioned reason, not indicated; patients are best wrapped in warm sheets and put to bed.

The Nauheim Bath.—Doubtless the effervescent baths of Nauheim exercise a very favorable effect. Compensatory disturbances are not only hindered, but, if already existent, may be again removed. The stimulation of the carbon dioxid prevents the vessels from relaxing as they do in a warm bath, but the heart is aroused to increased activity. A reflex stimulation of the vagus may, too, play a part, an effect which in the preparations of the digitalis group is recognized as one of the most important curative elements.

By gradually lowering the temperature from 33° C. and simultaneously raising the CO_2 content in the course of a few weeks, the demands on the heart are gradually increased and, as Aug. Schott expresses it, the baths become a gymnastic exercise for the weak heart.

Nauheim baths are not indicated in severe circulatory disturbances, in quickly developed failures in compensation, in angina pectoris, aneurysm, embolism, tendency to apoplectic attacks, in very nervous or reduced persons; and are only to be used with the greatest precaution in arteriosclerosis. Before one decides upon a CO_2 bath treatment, the lack of compensation should be observed for two or three weeks; it should be stabile, showing no tendency to become worse (Romberg).

Carbon Dioxid Baths.—Carbon dioxid baths may also be prepared at home. The CO_2 is usually generated from $NaHSO_4$ and $NaHCO_3$. The bath water is first raised to the desired temperature, then the bags or tablets containing $NaHCO_3$ are put in the water shortly before the bath is taken and the dissolving of the powder is accelerated by stirring. Then the cakes (with $NaHSO_4$) are placed on the bottom of the tub close to the body of the patient; in metal tubs, a piece of felt or rubber should be placed under the cakes, in order to protect the tub. The water is again stirred, the generation of CO_2 begins, and in a few minutes reaches the desired degree. Also, through the action of HCl upon Na_2CO_3, effervescent baths may be produced. Electric baths with alternating current, recommended by Budinger and Geissler, act in a similar way. They are faradic baths, with a stream of rising and falling intensity.

Mechanotherapy.—A few words will be devoted to the mechanotherapy of compensated heart lesions. It is a fact frequently observed that, through backward bending, the heart action may be slowed and strengthened. Heart massage, as prescribed by Oertel, may serve the same purpose. During expiration the hands pass from the axillary

line downward and inward with steadily increasing pressure; during inspiration the massage is discontinued.

Galvanization of the Sympathetic.—Application of the galvanic current to the sympathetic nerve has sometimes a beneficial effect on the heart action in strengthening and slowing it. According to Buxbaum, the procedure is as follows: An anode of 5 sq. cm. is placed below the lobule of the ear behind the descending ramus of the jaw, the cathode, of similar dimensions, being placed in the jugular fossa. The strength of the current should be from 1 to 3 MA., lasting for a few minutes, and any contractions upon opening or closing the circuit are to be avoided.

The Nauheim Treatment.—August and Theodor Schott developed a special method at Nauheim, in which brine baths, with or without the addition of carbon dioxid, are combined with systematic muscular exercise. This treatment, as Jürgensen confirms, leads in a short time to considerable diminution of the cardiac dulness and to a simultaneous strengthening of the pulse. Only when the cardiac power is sufficiently strengthened through resistance movements, Oertel's terrain-cure may be attempted. The muscular exercises of A. Schott consist chiefly of the following: The movements are performed very slowly, but with a certain expenditure of force; the resistance is created either through simultaneous innervation of the antagonistic muscles or, as in the case of the Swedish gymnastics, through the resistance offered to the movements of the patient by another person. The chief rule to be observed thereby is that the patient must never get so out of breath that he has difficulty in speaking. At the least suggestion of dyspnea or on any increase of the pulse frequency a pause should be made. In any case, this treatment is indicated only in cardiac weakness of lesser degree. Its contraindications are the same as those for the carbon dioxid baths.

In people, who as a result of their calling possess a well-developed musculature of body and heart, nothing is to be expected from gymnastic therapeutics (Romberg).

The Hot-water Bag.—If a temporary acute cardiac weakness with dilatation is to be combated, a rubber bag filled with water at 75° C. or still warmer may be applied advantageously, as recommended by the brothers Schott. Not only the entire anterior portion of the chest wall, especially the region of the heart, but also the back, may be exposed in this way to the action of heat as long as it can be endured.

Leiter's Cooling Apparatus.—Quite frequently, even in compensated heart lesions, Leiter's cooling apparatus may be helpful, especially in patients with a tendency to palpitation and tachycardia. Application of this apparatus upon the heart and eventually all over

the region of the medulla oblongata produces a marked slowing of the heart beat, and at the same time a strengthening of the cardiac action; also an existing slight arrhythmia may be occasionally removed.

Heart Supporter.—At times the discomfort of cardiac patients may be relieved to a great extent by the application of a bandage producing a certain pressure or fixation of the heart. Thus Abbée introduced a heart supporter, Graupner a heart compressor, which are said to be useful not only in cases of movable heart, but also in subjective heart troubles, bringing about an improvement which may be demonstrated objectively by the disappearance of preexisting arrhythmia. In earlier times plaster casts have been applied to the thorax with this object in view.

Medicinal Treatment of Compensated Heart Lesions.—Medicinal treatment has been applied in compensated heart lesions to prevent the occurrence of compensatory disturbances, and to remove, if possible, the anatomical cause of the circulatory disturbances or at least to improve it. Formerly much was expected from the iodin preparations on account of their absorptive powers. They were chiefly given in the form of sodium iodid in the hope of their absorbing endocardial aggregations. The anatomical changes found in developed valvular lesions render a medicinal influence impossible, and at most we could hope for some success from this preparation only before the vegetations of the endocardium have become organized. Still these expectations have not been fulfilled.

Nevertheless one is sometimes compelled to prescribe drugs for compensated heart lesions, but the warning must be given to give in small doses, but over a long period of time, those remedies which in compensatory disturbances are so beneficial in bringing about a return of compensation (Ortner). Lately Romberg has denounced the use of digitalis in "strengthening the heart" in entirely compensated heart lesions. In these cases "Fowler's solution, 2 to 10 drops several times a day, is recommended, or arsenic pills of the following formula:

Rp.	Acid. arsenic,	0.5
	Pip. nigr.,	5.0
	Gum. Arab.,	q. s
	ad pil. No. 100.	
	DS. Three pills daily.	

Each pill therefore contains 5 mg. arsenic, and this preparation is generally very well borne in spite of the rather high dose. Also the natural arsenic waters (Roncegno-Levico and Guber Spring) may be given, best a tablespoonful in some red wine. Also quinin and iron preparations of different kinds may be used, the common iron wines,

tincture of quinin and tinctura malatis ferri in equal parts, or the following formula:

Rp. Decoctum Chinæ, 10.0: 180.0
Syr. Cart. Aurant., 20.0
DS. One tablespoonful every two hours.

II. Compensatory Disturbances

Clinical Picture.—We have now to deal with the compensatory disturbances and their treatment. In lesions of the mitral valve the compensatory disturbances appear generally quite early, since the right ventricle is not able to hypertrophy to a large degree. The immediate consequence of the insufficiency is first the appearance of dyspnea, which is usually increased through the sequelæ of stasis leading to bronchitis, constipation, and flatulency. As an effect of the venous stasis on the central nervous system one observes the impaired faculty for mental work, and at the same time a peculiar psychical depression. Simultaneously symptoms arise on the part of the heart itself, especially palpitation, and, if the patient cannot spare himself, this symptom becomes aggravated rapidly and deprives him of his rest at night.

If the patient does not receive the proper medical treatment, he gets, within a few days, into a condition which obliges him to stay in bed; we observe in him the symptoms of venous stasis, a livid discoloration of the skin, swelling of the veins, especially on the neck during expiration, and dyspnea which prevents his lying horizontally, and often compels him to sit erect for several days. The examination constantly shows edema, which, together with the cyanosis and the frigidity of the peripheral parts of the body makes up the picture of a cardiac stasis. The liver is swollen, feels hard on palpation, and as a result of the stretching of its capsule is sensitive to pressure; the spleen is also enlarged and free liquid is present in the abdominal cavity. The urine is dark brownish-yellow, diminished in quantity so that sometimes only 100 c.c., or not much more, is evacuated in twenty-four hours; it contains a great quantity of uric acid, and albumin in greater or lesser amount is commonly found. The temperature is diminished, provided there is no coexisting cause for febrile rises, as a recurrent endocarditis. The metabolism is disturbed, the body substance breaking down, so that after the disappearance of the edema the weight of the patient is much reduced. The severe nutritive disturbance manifests itself sometimes in white patches of thrush in the throat, pharynx, and esophagus, and in the tendency to the appearance of decubitus.

The decubitus of cardiac patients differs from that developing in severe nervous diseases. Gärtner calls attention to the fact that the

former type of decubitus occurs whenever anemia is produced by pressure in the underlying portions of the skin, provided the pressure in the capillaries of the skin is smaller than the pressure which the weight of the body exerts on its under surface.

Examination of the Heart.—The examination of the heart, as previously mentioned, often does not show a clear picture at this period of the disease. The heart is generally markedly dilated, in most cases on both sides, but in others only on one side. The heart action is usually very rapid, in the minority of cases, however, slow, and constantly very irregular. In regard to the strength of the heart action we have to distinguish two groups: in the first the action is never strong, the pulse always being small and soft; in the second, while the heart is generally insufficient in force, sometimes a few quite strong contractions may be observed. In the first case the output of the heart is naturally small, the apex beat is not heaving, and the cardiac dulness not usually increased. We find this in cardiac failure, when transient or chronic fatigue of the heart muscle has developed through overexertion, and also in the healthy heart as a result of acute overfatigue.

In the second group, in which the heart acts with varying degrees of strength, the injury of the heart is of a less severe nature. In these cases the region of cardiac dulness is very extensive, the apex is heaving and the working capacity of the body, according to the alteration in the cardiac power, undergoes marked variations; the same is true of the quantity of urine. The heart sounds are sometimes pure, sometimes replaced by murmurs of changing character. This may be explained through the fact that the fibers are capable of work in very different degrees, that the irritability of the individual fibers is unequal, and it therefore depends upon the strength of the stimulus whether a part or all of the fibers are stimulated to contraction. If the stimulus is insufficient and only a part of the muscle fibers contract, the heart contraction will be of smaller effect; for not only are the contracting fibers small in number, but the uncontracted fibers lie between them like a dead mass, furnishing an obstacle to the shortening of the muscle, and the small resulting impulse is insufficient for the circulation. If the impulses become too weak, the corresponding pulse cannot be felt in the radial artery, and the nutrition of the heart itself begins to suffer (insufficiency of the coronary arteries). If, on the other hand, through the summation of stimuli, the cardiac musculature as a whole is stimulated to contractions, some cardiac impulses of considerable volume are produced, provided that enough healthy fibers are present.

Findings in the Blood-vessels.—Corresponding to the changes in the heart action we find in the peripheral vessels signs of the changed

periodicity and of insufficient filling; through the small output the veins are engorged and swell on expiration. This venous pulse is of normal type except in cases where we have to deal with a relative tricuspid insufficiency, where, together with a positive venous pulse in the neck, the liver veins pulsate synchronously with the heart action. On insufficient closure of the tricuspid valves, we find usually in the sphygmographic tracing of the cervical veins (instead of the diastolic and presystolic anadicrotic waves) two notches in the ascending limb of the pulse-wave, but in this case they do not correspond with the diastolic and presystolic contraction of the auricle, but rather with the presystolic contraction of the auricle and the systole of the ventricle.

Changes in the Blood.—The total quantity of blood shows, in circulatory disturbances, a diminution in specific gravity; but, at points where the blood-stream is retarded the red blood-corpuscles are generally accumulated and the arterial blood, therefore, is poorer in red corpuscles, the venous blood richer, than under normal conditions. The tissues in a unit of time receive not only a smaller amount of blood, but this blood is also poorer in oxygen carriers. Thus we can easily understand that in the state of cardiac insufficiency the toxic products of fatigue are not adequately removed, and greatly diminished functional capacity of the whole musculature of the body results.

Coagulation of the Blood.—The retardation of the blood stream, together with certain lesions of the vascular endothelium, facilitate the formation of thrombi; these are therefore to be found chiefly in those places in which a marked retardation of the blood-stream is most common, as, first of all, in the veins, but also in the right heart, rendering the danger of pulmonic embolism much greater than in the arteries of the greater circulation. However, arterial emboli are not so very infrequent.

Respiratory Organs.—The chief disorders of the respiratory organs in the course of circulatory disturbances are the congestive catarrh, bronchitis, brown induration of the lungs, cardiac asthma, hypostasis, hemorrhagic infarct, intercurrent pleurisy, and pneumonia, and, in a high grade of dropsy, also hydrothorax. Rosenbach points out that, in cardiac weakness, pneumonia of the right side, especially terminal, very frequently occurs, characterized by its afebrile course (asthenic pneumonia).

Kidneys.—The kidneys participate in the general stasis in the form of the cyanotic induration; the excretion of water is very much diminished, dropsy appears, following the laws of gravity in its distribution. Retention of the solid constituents or of material leading to severe intoxication, a true uremia, as in Bright's disease, is not observed; Jürgensen, however, in a case of renal insufficiency of cardiac origin, has observed a symptom-complex which in all probability is nothing

else than an autointoxication. The injury to the kidney from the congestion does not seem to be a very severe one, for if the stasis is successfully removed, the renal function regains its full capacity, and no lasting detrimental effect is to be feared.

Digestive Organs.—The discomfort on the part of the digestive organs furnishes often, indeed, the first symptom in cardiac patients. At the beginning of the disease they complain of constipation, and the appetite is sometimes diminished very early, but in other cases it is quite normal; there is a bad taste in the mouth and *fœtor ex ore*. v. Noorden has proven that the motor function of the stomach generally does not suffer, and that only in severe cases of cardiac weakness a considerably diminished production of hydrochloric acid occurs. The resorptive power of the intestine is in general not bad, at most the resorption of fat suffers a certain diminution. Constipation is more frequent than diarrhea. The decomposition of proteins is within the normal limits.

Tongue.—M. Laub has recently called attention to the changes in the tongue, sometimes quite striking, in circulatory disturbances. "The tongue is swollen, the mucous membrane loose, cracked, with a thick grayish coating; on the edges of the tongue, also on its upper surface, many ulcerous spots appear, of the size of a lentil, surrounded by a grayish-yellow wall; they are entirely painless." He states that careful observation of these changes of the tongue may furnish an indication for giving or interrupting heart tonics.

Liver.—In regard to the liver changes following stasis, it may be noted that the formation of urea is not affected; the secretion of the bile perhaps more, as a result of the lessened food consumption, food, as is well known, being the strongest cholagogue. Subjects of severe heart lesions often show a subicteric tinge; the urine is free from biliary pigments, but contains a large amount of urobilin. v. Noorden explains this on the supposition that, through the destruction of many red blood-corpuscles, a thick, tenacious bile is formed, rich in coloring matters, which is secreted with difficulty. The outcome is the resorption of a small amount of bile in the liver, while the rest, poured into the intestine, is then transformed into urobilin and as such excreted.

Nervous System.—It has been mentioned above that disorders of circulation are associated with the incapacity for mental work and with psychical depression. Sometimes, indeed, the so-called heart-failure psychoses result. v. Krafft-Ebing, however, on the ground of large statistics, emphasizes that the importance of cardiac affections for the pathogenesis of psychoses has been very much overestimated. According to Mildner and others, hypertrophy of the left ventricle and lesions of the aortic valves tend more to maniacal psychoses, while diseases leading to hypertrophy of the right ventricle tend rather to depression psychoses. Krafft-Ebing asserts that the cases described

by Mildner as mania are in fact melancholia agitata. However this may be, in cardiac lesions we often find depression; in other cases, especially at the onset of circulatory disturbances, the sense of oppression. In severe cyanosis the cerebral cortex ceases to functionate, the patients become somnolent, the dyspnea ceases, and they die after weeks of painful suffering. Focal symptoms in the brain may be produced by thrombi and emboli. On the postmortem table the meninges are sometimes found thickened and cloudy, a sign of long-existing hyperemia and cerebral edema.

Physiological Explanation of Compensatory Disturbances.—We shall touch in a few words the question as to how, in fact, the circulatory disturbances arise. Hypertrophy of the cardiac muscle is apparently a compensatory process which neutralizes the obstacles to circulation. Since the hypertrophied voluntary musculature, for instance that of an athlete, does not suddenly fail in performance of its work, an explanation seems to be necessary for the fact that the cardiac muscle becomes insufficient sooner or later. Krehl states that an infection of the endocardium is constantly associated with an infection of the heart muscle, a more or less extensive myocarditis of indurative and progressive type. This explains the circulatory disturbances in valvular lesions of endocarditic origin. But valvular lesions may be brought about in another way than by infection; through a too great increase of blood pressure one aortic valve may rupture, and the greater part of congenital heart lesions do not develop from fetal endocarditis, but from malformations. The only explanation for these cases is that the heart muscle is *a priori* functionally more incompetent and therefore incapable of a sufficient hypertrophy, or that we have to deal with an increase of circulatory hindrances, whether from cicatricial contraction or from other mechanical reasons, as dilatation of the cardiac orifices.

Subjects of old heart lesions may die following great psychical emotions or after intense physical exertion; but sometimes we are unable to find a definite cause why the cardiac power gave way at the moment of death (death during sleep). Postmortem one may find pericardial adhesions, stenosis of the coronary arteries, rupture of the heart, etc. (Vibert).

A very frequent cause of death in compensated heart lesions is croupous pneumonia.

Treatment.—If we have to deal with the lightest forms of circulatory disturbances manifesting themselves through some edema of the ankles in the evening, but disappearing overnight, it is advisable to restrict at once all demands upon the heart as far as possible. Complete rest in bed is absolutely necessary, and if we are unable to meet this indication, we may have much difficulty in getting rid of even the

lightest degrees of circulatory disturbances. Careful nursing of the patient is indispensable. He must be protected against loss of heat, the bowel movements must be regular, the temperature carefully controlled, since any increase in temperature awakens the suspicion of a recurrent endocarditis and directs our attention to the bronchitis usually present.

Diet.—In all those cases in which the cardiac power has suffered to a greater extent Oertel advises rather for some time not to force the diet, but, above all, to limit the supply of liquids; large amounts of solid food should not be taken at one time. The meals should be frequent and small, consisting of meat in every form, bread and butter, sweets, cakes, salads, compote, and raw fruit in small amounts. If the patient's appetite is not satisfied on the small rations during the day, he may at night have a small meal consisting of a meat sandwich, an egg, etc. Oertel allows tea and coffee only if there is no palpitation; he prefers, however, fresh milk as a beverage. From an almost exclusive milk diet, but not in too large a quantity, one may see a rapid disappearance of the dropsy, due to the diuretic action of the milk. With the milk, salt-free foods may be given, as bread baked without salt. The following may serve as beverages: strong bouillon with egg; for the thirst good fresh water; no effervescent waters nor alcohol, since alcohol acting on the accelerator nerves of the heart may in severe congestion of the lungs lead to hemoptysis. Only when strong excitants are necessary, Oertel concedes the use of heavy wines. The total quantity of liquid taken in the twenty-four hours must not exceed 1 liter. Only when the circulatory disturbances have manifestly improved may one allow the patient to get up, at first for one hour, later on for several hours each day. On any physical exercise which we allow the patient, the pulse and respiration should be carefully controlled. Every increase of the pulse above 100 is injurious to the heart, leading to a shortening of the diastole and to insufficient nourishment of the cardiac muscle. Liebermeister recommends allowing patients to walk as long as their pulse frequency does not exceed 100 the patients themselves controlling their pulse count. He sees in this method the advantage that the patient, constantly giving attention to his own pulse, will avoid all overexertion. However, in patients inclined to hypochondria, this may prove a bad plan.

When the circulatory disturbance is again adjusted, the régime used before the ailment began may again be reestablished. Those therapeutic measures which have already been discussed in the treatment of cardiac patients without circulatory disturbances, may be used at the time of lost compensation, but with greater precaution; one may try Leiter's cooling apparatus and the carbon dioxid bath.

A protracted indifferent bath of 35° C. for one hour may be used with good success for stimulating diuresis (Winternitz).

The sovereign drug in combating circulatory disturbances, especially in mitral lesions, is digitalis.

Digitalis.—The digitalis preparations act on the left ventricle, effecting a more thorough emptying through forceful contraction; the heart, under its influence, works with the greater part of its power, while its absolute power is not increased. The pressure in the lesser circulation is indirectly diminished in this way, whereas it increases in the greater circulation. This effect is produced in part by the action of digitalis on the vessels. The abdominal and cardiac blood-vessels become constricted, the pulmonary vessels remain unchanged, while those of the brain and of the periphery are dilated. The heart action is retarded, sometimes to a half of its former frequency, an effect probably due entirely to the cardio-inhibitory nerve fibers.

Notable is the sinking of the blood pressure observed at times following the use of digitalis, especially in coexisting nephritis (Romberg).

The statement which, since Traube, is always repeated that digitalis is contraindicated in increased blood pressure, as, for instance, in granular kidney, on account of the danger of apoplectic attack, is as groundless as its contraindication in arteriosclerosis. To be sure, in such cases we will proceed with great precaution and begin with small doses.

Only if a pronounced tendency to embolism or hemorrhage exists or if an aneurysm is demonstrated one will do well in avoiding this remedy if possible (Romberg). Digitalis fails in paresis of the vagus, in reflex affections of the heart, often also in diseases of the right ventricle, in myocarditis and fatty heart, as well as in severe general dropsy. In renal insufficiency it should be used only with the greatest precaution (Lewin, "The Secondary Effect of Drugs").

It is a well-known fact that digitalis has a cumulative action through its slow absorption and slow excretion; Lauder Brunton explains this through the specific effect of digitalis, which constricts the renal vessels and retards in this way the elimination of its active principle. It is questionable whether this or any other theory explains sufficiently the cumulative effect of digitalis, yet a week after its administration its action may be plainly demonstrated on the pulse. There results from this the practical conclusion of using digitalis only in small doses, and of decreasing these doses still more as soon as its effect is observed. It is important to know well the symptoms of intoxication by digitalis, since one sometimes observes in spite of the greatest care, slight manifestations of intoxication, probably due to idiosyncrasy of the patient. In this case the drug must, of course,

be discontinued at once. The patients complain of vertigo and vomiting, the pulse is usually very slow and irregular, but sometimes, especially in severe intoxications, very fast. In one case "yellow and green vision" has been observed. Diarrhea or the aggravation of diarrheic conditions is sometimes noticed, especially in small children.

It is advisable to prescribe the folia digitalis in doses of 0.3 to 1 to 1.5 gm. to 200 c.c. water, either after maceration for twelve hours or as an infusion. After three such doses are taken a pause is made for several days. Since the digitalis leaves differ very much in their activity, the greatest caution is required. The leaves collected in the fall are about four times as active as those collected in the spring. For children, Seifert in his "Pocket Formulary for Children's Diseases" advocates the following doses:

1–2	years,	.02 gm.	pro dosi	.1 gm.	pro die
3–4	years,	.02 gm.	pro dosi	.12 gm.	pro die
5–10	years,	.03 gm.	pro dosi	.2 gm.	pro die
10–15	years,	.04 gm.	pro dosi	.3-.5gm.	pro die

The tincture of digitalis is not to be recommended on account of its inconstant composition, but the powdered leaves may be given in corresponding doses with sugar, for instance:

Rp. Pulv. fol. digital., 0.1
Sacchari, 0.4
DS. One powder every three hours.
D. t. d. Nr. X.

Eichhorst prescribes:

Rp. Fol. pulv. digital., 0.1
Diuretin, 1.0
DS. Three times daily for ten days, and interrupt the medication if the pulse frequency sinks below 60.

Romberg gives digitalis in the form of pills:

Rp. Pulv. fol. digital., 0.05
Pulv. et succ. liquir q. s. ut f.
pilul D. tales pilul Nr. XXX–L.
DS. Two pills 3 times a day until 1.5 to 2 gm. of the leaves are taken (thus 30 to 40 pills).

In arteriosclerosis, granular kidney, heavy smokers, drinkers, subjects of the uratic diathesis and patients with sensitive stomach, he starts with 1 pill, three to four times daily.

Robust children of ten to fifteen years receive 4 to 6 such pills; between seven and ten years 3 pills, and children still smaller receive 3 to 4 pills of 0.025 gm.

In those cases in which digitalis is badly borne and leads to vomiting, Frantzel advises to have a very strong infusion made, to cool it on ice, and to administer it with small pieces of ice or with mistura gummosa; he applies digitalis also in the form of an enema, using, for instance, an infusion of 1 : 60 for two enemas in a day. Suppositories of the pulverized leaves and cocoa butter may be prescribed, and two or three of them may be applied daily, each containing 0.2 gm. of the powder.

The infusion of digitalis is not suitable for subcutaneous injection, as it produces painful infiltrations at the point of injection.

Different active principles of digitalis, of the nature of glucosides, have been isolated by different experimenters. The digitalin Nativelles, containing chiefly digitoxin; the digitalin Homolles, and the digitalin, digitonin, digitalein, and digitoxin, prepared by Schmiedeberg, have all been tried more or less, but have not gained a hold in practical therapeutics, partly on account of their variable action and partly owing to their extraordinarily poisonous nature.

Also to be recommended is the dialysatum foliorum digitalis of Burger, of which 1 gm. is equal to 1 gm. of fresh leaves, or to 0.2 gm. of the dried leaves. This preparation excels through its constant composition and through the fact that its dose is physiologically tested.

In recent times digalen has been highly recommended (Digitoxinum solubile Cloetta) 1 c.c. of the solution contains 0.3 mg. digitoxin and is said to correspond to 0.15 gm. folia digitalis. One gives 1/2 to 1 c.c. internally three times a day. On more prolonged use (the chronic digitalis cure of Kussmaul, Groedel, Naunyn, Achert) a few drops are given three times daily. Taken internally, diluted with water, it is, as a rule, well supported, and the effect is a satisfactory one.

The subcutaneous application of digalen is painful and is followed by local inflammation, whereas the deep intramuscular injection into the glutei or into the extensors of the thigh is painless and, through the quick resorption, very effective.

In cases of imminent danger, when the immediate effect of digitalis is desired, digalen may be injected intravenously. One injects 1 c.c. and may repeat the dose once if necessary.

It may also be applied as an enema, diluted with water. Since digalen acts faster than the infusion of digitalis it will be especially useful in those cases in which the long period of latency which elapses before the action of digitalis infusion takes place, is undesirable.

According to Ortner, the digitalis preparations act the best in mitral insufficiency, not so well in aortic regurgitation, and not at all

in coronary sclerosis, in fatty degeneration of the cardiac muscle fibers, and in indurative myocarditis; for they act here, to use Ortner's comparison, as a whip on a tired horse. According to his idea, the heart is no longer able to react to this stimulus, and the preparations of digitalis would in these affection be more harmful than useful. The divergent opinion of Romberg is mentioned at another place.

It is an undoubted fact that just because the heart muscle is much injured in its functional capacity, any kind of heart tonics will produce an incomparably smaller effect than in cases where the heart muscle is still competent and the compensatory disturbance has been brought about by some transient cause. Still it is not easy to comprehend why digitalis should occupy a position different from that of all other heart tonics. If the working power of the heart is deficient one will strive not only to lower the demands on the heart, but by the use of tonics to increase this working capacity, and among the heart tonics digitalis certainly occupies the chief rank. On the other hand, Ortner himself recommends that a trial be given digitalis in aortic lesions, and in the failure of the digitalis treatment he sees a diagnostic and prognostic criterion. Even in angina pectoris one may see good results from digitalis if the cure is not pushed until the blood pressure rises too high.

In certain cases, however, the use of digitalis is undoubtedly contraindicated, namely, where we have to deal with "true" bradycardia. We use this expression for the reason that we must first convince ourselves through careful examination of the heart, that the bradycardia observed on examination of the pulse in reality exists; for, as we know, in many cases a false bradycardia is due to the non-transmission, peripheralward, of heart contractions. In cases of true bradycardia it may be useful to add to the digitalis infusion, sulphate of atropin to prevent a further retardation of the pulse by stimulation of the accelerator nerves. One may give 1 mg. of atropin *pro die*, mixing it with the daily dose of the infusion. Lewin believes that digitalis is contraindicated in febrile diseases. Liebermeister has expressed the opinion that the threatening cardiac weakness in pneumonia cannot be prevented through this medication. He thinks the higher the pulse is, the less is digitalis indicated. Some authors consider digitalis more harmful than useful in bronchitis and acute pulmonary tuberculosis. The administration of digitalis in pneumonia is, however, advocated by some authors. Occasionally it is advisable, as Eichhorst emphasizes, to combine with digitalis alcohol or caffein, or to precede the digitalis treatment with these drugs. Since the accelerator nervous fibers are in a state of excitation there is no danger of a resulting bradycardia. In strong and robust patients Huchard advises the com-

bination of digitalis with an exclusive milk diet. In the beginning he gives the patient only 1 1/2 liters of milk every day for five days; from the third to the fifth day the patient receives 0.1 gm. of pulv. fol. digital. three times a day. Especially in dyspnea and severe cardiac asthma, surprisingly good results may be obtained.

In pronounced cases of arteriosclerosis one may fear that the rise of the peripheral blood pressure may lead to hemorrhages and may combat the fluxionary hyperemia best by the use of ergotin (Rosenbach), which, through contraction of the peripheral vessels, influences congestion conditions most favorably. Still one must guard against giving ergotin in the beginning of digitalis treatment, since the resistance in the systemic circulation is considerably increased and demands are placed upon the heart to which it is unable to respond if the effect of the digitalis has not reached its height.

When this has once been attained it is advisable in most cases not to continue digitalis in *refracta dosi*, but to discontinue its use for some weeks, if possible. In those cases, however, where certain symptoms persist, one will nevertheless have to make use of small doses of digitalis for some time. Thus in mitral regurgitation the compensatory disturbance may be removed, but, through the raised blood pressure in the lesser circulation, dyspnea results. At the same time the patients complain of palpitation and sensations of oppresion in the region of the heart, and folia digitalis, in small doses, 0.25 gm. *pro die*, may then give remarkable relief.

Strophanthus.—Next to digitalis, strophanthus deserves a prominent place in the medicinal treatment of compensatory disturbances. The active principle of the tinctura strophanthi acts directly on the heart muscle, strengthening the pulse, diminishing the frequency and increasing, if only to a small degree, the arterial blood pressure. The effect of tinctura strophanthi is very rapid, taking only a few hours; a cumulative action as in the case of digitalis is not observed. Strophanthus often fails in cases where digitalis is still effective. In idiosyncracy for this drug, or if given in too large doses, nausea and vomiting, ocasionally symptoms of renal irritation, are produced. The dose for adults is 5 to 10 drops three times a day; children should not receive more than 1 drop three times a day, and only at the time of puberty should the dose be very gradually increased to 2 drops; in the first years of life children should not receive strophanthus at all. In any case, a patient receiving strophanthus must be watched as carefully as has long been the custom in digitalis. Of the newer preparations, strophanthin Wurtz in pills of 1 to 2 mg., to be taken once or twice daily, may be recommended; also the granules de catillon strophantine in doses of 1/10 mg., 1 to 2 granules three times a day.

Heart Tonics Less Commonly Used.—The sulphate of spartein in doses of 0.02 gm. three times a day has been recommended by Germain Seé; injected subcutaneously it is painful. Other cardiac tonics are convallaria majalis, as infusion or tincture; adonis vernalis in infusion.

Rp. Infus. Adonid. vern., 5.0:180.0
Syrup. capill. veneris, 20.0
DS. One tablespoonful every two hours.

Kisch recommends the following prescription:

Rp. Tct. digital., 2.0
Tct. strophanti,
Tct. convallar. majal, ää 5.0
Tct. chinæ compos., 25.0
DS. 10 drops every hour.

Ortner obtained good results from the dialysatun Adonidis Goltz, giving 20 drops three to four times daily, or 5 drops every hour.

Caffein.—Caffein is a great favorite as a cardiac tonic, stimulating at the same time diuresis. One sometimes sees favorable results from its use in cases where digitalis fails. Caffein is commonly employed in the form of double salts, sodium and caffein benzoate, sodium and caffein salicylate, and sodium and caffein cinnamylate, given in doses of 0.25 gm. three or four times a day. Also for children the double salts of caffein are used in regulation of the heart action, alone or in combination with digitalis. The daily dose varies from 0.01 to 0.5 gm. of the double salts, while the pure caffein is, according to Seifert, given in doses of 0.02 to 0.06 gm. *per dosi.* In general one will prescribe the double salts when an increase of cardiac action is desired. Seifert gives the following prescription:

Rp. Caffein. natrio salicylic., 0.2
Inf. folior. digital., 0.2
Ad. colat., 80.0
Syr. rubi. idæi., 20.0
DS. One dessertspoonful every two hours.
This would be a dose for a child of one to two years.

Caffein, as well as theobromin, is, according to the French authors, similar in its action to digitalis, and especially in the cardiac insufficiency of fat persons it is said to be superior to digitalis (Romberg).

In those cases where a copious diuresis is desirable one may cautiously increase the dose. Still one must always keep an eye on the gastric symptoms, since caffein is often badly borne by the stomach. This is entirely in accordance with the observations made by A. Pick, that of all drugs caffein is the only one that markedly increases the

fermentation process in peptic digestion. In cases where caffein is not well tolerated internally or where a rapid effect is desired, one may give it subcutaneously; for instance, the caffein natrio-benzoic, 0.2 to 0.3 gm., several times a day.

Kola Nut.—After caffein we may mention the seed of the kola nut, which itself contains caffein. It is used less in organic heart diseases than in neurasthenic disorders of the heart, and generally in the lighter states of exhaustion of the whole musculature common in nervous persons.

Strychnia.—Strychnia may occasionally be used as a heart tonic with advantage, and, in England especially, it is given for its effect in raising the blood pressure; it may be prescribed as strychnin nitrate, as tinctura strychni, as tinctura nucis vomicæ, and as extractum strychni. Like digitalis, strychnin preparations are said to possess a cumulative action; one will therefore begin with small doses and increase only gradually and cautiously. It is very important to know the first symptoms of strychnin intoxication: it announces itself by an increased irritability of the nervous system, in its sensory and motor functions; the reflexes are increased and the sensory impressions are perceived in a much more striking and disagreeable manner; this property is made use of therapeutically to improve conditions of paralysis and sensory omissions. We employ strychnin less frequently in heart disease proper than in nervous heart affections, and thus strychnin is a popular ingredient of many tonic compounds, for instance, in syrup of hypophosphites (Fellows), which contains 1 mg. of strychnin in every teaspoonful. Strychnin is often given in threatening cardiac weakness, in the course of acute infectious diseases (diphtheria); of the tincture 1 to 2 drops daily for infants; 2 drops three times a day for children of three years; 3 drops three times a day for children of ten years, and thus gradually increasing; the nitrate of strychnin may be given subcutaneously in doses of 1/4 to 1 mg. (Seifert).

Camphor.—Among the drugs which are employed to spur on the insufficient heart to adequate activity camphor occupies a chief place. Camphor may be given as triturated camphor with mixtura gummosa or in powders combined with powdered digitalis, in doses of 0.2 gm. three times a day. In dangerous cases where the pulse can no longer be felt and the extremities are cold and cyanotic, two to three syringes of camphorated oil may be given several times a day. v. Jaksch and A. Pick believe camphor to be the best analeptic of all drugs.

Ether.—Like camphor, ether is largely used as an analeptic, in the form of sulphuric or acetic ether, the latter more fit for internal medication on account of its agreeable taste and smell. Also the spiritus ætheris, a mixture of one part ether to three parts alcohol, is an old,

trusted analeptic which is best given on sugar in doses of 10 to 30 drops. The application of ether injections has certain disadvantages. The injection is very painful and leads to unpleasant infiltrations, sometimes, indeed, to a small circumscribed gangrene of the skin. If a nerve is pricked paresis may be produced; therefore, the point of injection must be carefully chosen. Paralysis of the radial nerve has been observed after ether injection in the arm. As enema, ether may be given in doses of 1 teaspoonful to 100 to 200 c.c. water. On account of its analeptic action, ether, as a general anesthetic, is to be preferred to chloroform in cases where one suspects danger from the heart; especially for minor surgery ether inhalation is very valuable, small operations being performed during the first effect of its vapors on the nervous system. As a general anesthetic, ether produces a long state of excitation and has an irritating effect on the respiratory organs.

In general the rule holds that in heart diseases chloroform is to be avoided; in lung and kidney diseases, ether.

Choice of Analeptics.—Ether, camphor, and strychnin have their well-defined limitations in the treatment of cardiac weakness, and the choice of each remedy depends on the manner of its physiological action. The ether injection has the most rapid effect, but it vanishes after a short time. Later, perhaps after half an hour, the camphor injection shows its action, which is, however, longer in duration. Latest, after one or two hours the action of strychnin sets in, and in accordance with its long period of latency its effects are more lasting. One sees from this that, in cases of sudden danger, ether and camphor ought to be chosen; in the protracted form of cardiac weakness camphor or strychnin should be given. In some conditions two of these preparations may be advantageously combined. Thus an ether injection may be immediately followed by a camphor injection or ether and camphorated oil in equal parts may be injected at the same time.

Alcohol.—Our standpoint on the question of alcohol as a medicament we have already defined in the treatment of elevations of temperature. We certainly consider it wrong to urge individuals who have never taken alcohol to take it for cardiac weakness, and the practice of giving patients alcohol *ad libitum* ought certainly to be condemned. This remedy should be dosed like any other, and not only the constitution of the patient, but also his previous habits in regard to alcohol must be considered. In cases of delirium tremens with threatening collapse, one must naturally, considering his previous strong potations, respect the alcoholic needs of the patient to the greatest extent. Very good success is obtained from alcohol, if given immediately before a bath, in the course of severe febrile diseases. Through its action as a vasodilator alcohol prevents the peripheral

vessels from contracting under the stimulus of cold water and hinders a very undesirable secondary effect of the cold bath, the sudden increase of resistance in the systemic circulation leading to markedly increased demands on the heart. Since through the cold bath one wishes to lower the blood temperature, the vasodilatation is in this sense beneficial to the patient, the temperature increase abates the pulse becomes slower, and the feverishly racing heart has time to recuperate.

III. Congenital Heart Lesions

The congenital heart lesions represent a very large class of diseases, which may be traced back in part to anomalies in development, in part to fetal endocarditis. One finds defects of the auricular and ventricular septa, stenosis and atresia of the pulmonary artery and aorta, in the region of the ostium or conus; the latter case is usually combined with defects of the septum and transposition of the great vessels; the ductus Botalli may persist and at the point of its junction a high degree of narrowing may exist; further, at the venous orifices, through arrested development or fetal inflammatory processes, stenosis may be present; inflammatory changes may lead to stenosis of the orifice and conus of the pulmonary artery, sometimes combined with open foramen ovale. It is easily understood that any of these disturbances will lead, in a much higher degree, to circulatory disturbances than is the case in acquired diseases of the valvular apparatus; for in most cases the right ventricle would have the work of compensation. On the other hand, these disturbances produce changes so severe that life cannot be maintained; in some cases, however, the patient may live even for a score of years.

In our treatment we will give our attention to all those points which are of moment in the treatment of acquired heart lesions. In pulmonary stenosis our attention must be directed to still another factor. It is a well-known fact that subjects of this heart lesion have a peculiar disposition to pulmonary tuberculosis, and we have therefore not only to give our care to the improvement of the heart, but also to prevention of this danger.

IV. Diseases of the Cardiac Muscle

Idiopathic Hypertrophy of the Cardiac Muscle.—We shall now turn to diseases of the cardiac muscle. In the first place, we have to mention the idiopathic hypertrophy of the heart muscle. For the development of this condition a primary dilatation is essential and we have therefore to consider all factors leading to dilatation as pathogenetic agents in the hypertrophy. Overexertion of the body leads occasionally to cardiac hypertrophy; still, not seldom one sees persons who re-

spond only with a strengthening of the heart muscle, and others who from a single or prolonged too great exertion of the muscle suffer a dilatation; this dilatation under favorable conditions may again disappear or, on the other hand, may lead to a persisting eccentric hypertrophy of the heart. Next to overexertion a too abundant use of liquids is the most important factor. A proof of this is the frequent occurrence of this hypertrophy in the beer-drinking people of Munich, it certainly being wrong to make the alcohol contained in the beer responsible for the injury to the heart's power. At a more advanced age cardiac hypertrophy may be observed due to the overexertion of the heart resulting from the increased resistance in the circulation due to arteriosclerosis.

It is entirely wrong to consider the hypertrophied heart as one with a superabundance of muscle, and therefore especially efficient. The tendency of the hypertrophied heart to become insufficient is rather due to its decreased reserve power, as Martius has explained.

In the treatment of this condition the greatest stress has to be laid on prophylactic measures. Patients whose heart power has been injured through a severe disease, or whose hereditary predisposition allows one to suspect a weak heart, must be warned most emphatically of the danger of the development of a severe ailment if they place too great demands on their heart power, whether through sports or excessive drinking. In the beginning of the evil, which announces itself by palpitation, dyspnea on going upstairs, and eventually by arrhythmia, the return to a regular life will in a relatively short time cause all discomfort to disappear. But a relapse to the previous pernicious manner of life may again provoke the same disorders, this time with more severe consequences. When a marked insufficiency of the cardiac muscle has once become established, the same principles which have been discussed in the treatment of uncompensated heart failure have to be applied here. By digitalis treatment one may often accomplish very good results in these cases, and even when the heart power is entirely reduced, one may succeed, with camphor or strophanthus, in overcoming the imminent danger. Undisturbed health, however, will scarcely be enjoyed again, though, by appropriate measures life may be made tolerable for years.

Fatty Heart.—When fat becomes accumulated in the fat depots of the body, the subpericardial connective tissue becomes covered with fat, especially over the right ventricle, whose wall in a great part appears to be substituted by a mantle of fat. But the fat infiltrates the cardiac musculature also. This deposition of fat in the heart is designated commonly as "Mastfettherz." As we find occasionally in phthisis not only fatty degeneration of the liver, but a real deposit of fat in this organ, so we may find in consumptive diseases, as pul-

monary tuberculosis and carcinoma, not only fatty degeneration, but occasionally also a true fatty heart, with an actual deposit of fat. This is probably due to the decreased power of oxidation and resorption. This deposition of fat ought to be well distinguished from the occurrence of fat in the heart muscle fibers in the form of very small drops, which we designate as fatty degeneration. This is the cause of severe cardiac disorders in grave blood diseases, and in general infections and intoxications. Local ischemia of the myocardium, as produced through arteriosclerosis of the coronary vessels, may lead to fatty degeneration. This process is sometimes found in the hypertrophied heart muscle without coexistent narrowing of the lumen of the coronary vessels. The existing ischemia may in this case explain the fatty degeneration, the coronary vessel being able to supply the normal heart with a sufficient quantity of blood, but not the hypertrophied heart.

The diagnosis of fatty heart is difficult. For it is hard to get a picture of the heart without radiological examination, on account of the great masses of fat on the thoracic wall; the heart sounds are always soft and dull from the bad conduction of the thoracic wall. We are then led to infer the deposition of fat in the subserous connective tissue in very corpulent persons if severe disorders in the heart action arise. Not all complaints of obese persons, however, as their clumsiness, tendency to fatigue and dyspnea, should be ascribed to the fatty heart, for very different factors may produce circulatory disturbances in corpulent people. At advanced age arteriosclerosis is very often connected with obesity. Yet it is undoubtedly true that fatty heart may occasionally cause severe symptoms, the more since, in its severe forms, other changes are to be found in the heart muscle, as myomalacic areas and induration.

Therapy of Fatty Heart Caused by Overfeeding.—The prophylaxis of fatty heart is covered by the prophylactic measures against a too abundant fat deposit; generally moderation in eating and drinking will guard against severe injury, even in those cases where a certain disposition to corpulency and its associated disorders on the part of the heart exist. If a pathological degree of obesity already exists which causes discomfort to the patient, it will be advisable to combine with a slow and cautious antifat treatment measures which aim to strengthen the heart muscle. Nourishment rich in proteids should be given; the main points of Oertel's treatment should be followed, consisting of the utmost limitation of liquids and in methodical, carefully estimated work for the cardiac muscle with the aim of strengthening it (terrain-cure of Oertel).

A too rapid method of reducing obesity must be avoided, since the patients indeed lose in body weight but certainly experience no

improvement on the part of the heart. The treatment with thyroid extract is not to be recommended in hearts which are not intact; it may aid in an anti-fat cure and, in fact, even if the form of diet is unchanged, its use may accomplish a loss of weight, but we produce through it hyperthyroidism, presenting symptoms similar to those in Graves' disease, namely, tachycardia and sensations of palpitation. This secondary action is certainly very undesirable, and, therefore, on the existence of cardiac complaints, one will give thyroid extract only with great precaution, having the patient under constant observation. If this is impossible, it is better to abstain entirely from this medication.

Antifat cures cannot very well be put in a schematic form. Generally spoken, it will be advisable to restrict carbohydrates and fats as far as possible, but to give meat and cellulose in abundance. The cures most in use are given below; still in given cases one will not hesitate in making variations.

Banting prescribes the following dietary:

Breakfast: Beef or mutton, kidneys, broiled fish, ham, or some other cold meat (with the exception of pork), 120 to 150 gm.; a large cup of tea (without milk or sugar), zwieback or toasted bread (without butter), 30 gm.

Luncheon: Fish (with the exception of salmon) or meat (with the exception of pork), 150 to 180 gm.; vegetables (no potatoes); toast, 30 gm.; compote, red wine, sherry or madeira, 2 to 3 glasses (no champagne, port wine, or beer).

Afternoon: Fruit, 60 to 90 gm.; 1 to 2 large zwiebacks; 1 cup of tea (without milk or sugar).

Supper: Meat or fish (as for luncheon), 96 to 120 gm.; red wine, 1 to 2 glasses.

Ebstein's cure is less strenuous and differs from that of Banting chiefly in that fat is permitted in moderate quantity. For breakfast he gives tea without sugar, with some bread and butter; for dinner he prohibits all food rich in carbohydrates, but permits even fat meat and leguminous foods. For supper not only fat meat, but also some bread and butter is allowed. By long continuation of this régime considerable reduction in weight may be accomplished without the patient's suffering too much from this subnutrition.

Oertel's cure consists in a diet also rich in protein, but poor in fat, and especially in carbohydrates. Oertel gives:

Morning: 50 gm. bread, 130 c.c. coffee, 20 c.c. milk, 10 gm. sugar.

Noon: 150 c.c. soup, 200 gm. boiled beef, 100 gm. vegetables, 150 gm. bread, 50 gm. salad, 100 gm sweets, 50 gm. black bread, 125 c.c. Rhine wine.

Afternoon: 130 c.c. coffee, 20 c.c. milk, 10 gm. sugar.

Evening: One soft egg; roasted meat, 150 gm.; green salad, 150 gm.; bread, 50 gm.; Rhine wine, 250 c.c.; water, 250 c.c.

We see, therefore, that in this dietary a considerable decrease of liquid is accomplished. Rosenfeld, however, states that this cure may occasionally lead to conditions of severe weakness, to great nervous exhaustion, and very often to irritation of the kidneys through the excretion of the concentrated urine.

It must be admitted that, as introduced by their founders, all three cures may lead not only to the breaking down of fat, but also to that of protein. Retaining, therefore, the principles of this treatment, one will always have to make concessions to the strength of the patient, controlling him constantly. But in fact many corpulent persons tolerate subalimentation very well; this is confirmed by the observation of v. Noorden and Dapper, that an obese person may lose considerably in weight, and at the same time increase somewhat his stock of protein, if albuminous food is supplied to him in sufficient amount. It results, therefore, that obese persons gain more easily a deposit of proteins than healthy individuals on a supply of calories below the normal.

Schweninger's modification of Oertel's system also deserves mention. He allows somewhat more liquid than Oertel, but does not permit drinking during meals. This method, too, may weaken the patient, since many patients are unable to eat if they are not allowed to drink at the same time.

Fatty Degeneration of the Heart.—In the fatty degeneration found in the course of infectious diseases, intoxications, and cachectic conditions, one will first seek to counteract the primary disease; in diphtheria, for instance, we will aim first to remove the poison from the organism as early and completely as possible. In those cases in which the cardiac weakness is really the result of poisoning of the heart muscle, and does not originate in the peripheral vascular system, as may be the case in infectious diseases and intoxications, good results may be obtained by alcohol mixed with some food substances. If the peripheral system is affected, the best treatment will consist in the application of cold water.

Stocke's mixture may be recommended, consisting of brandy, cinnamon water, and syrup of orange peel, to which the yolk of several eggs are added.

Rp.	Spirit vini cognac.,	50.0
	Vitell. ovi unius	
	Syrup. cinnamomi,	20.0
	Aq. destil.,	q. s. ad 150.0
	Event Tct. valerian æther,	5.0

MDS. 5–10 tablespoonfuls daily (Romberg).

If the cardiac weakness reaches a threatening point, the analeptics discussed above, ether, camphor and strophanthus, will be employed. Morphin, by no means always contraindicated in weak heart (as in pulmonary edema), must be avoided in those cases of insufficiency resulting from degeneration of the heart muscle where Cheyne-Stokes respiration has shown itself. For this may not only be increased by the administration of morphin, but directly incited by a morphin injection. Dionin and salts of bromin may serve as substitutes for morphin.

Inflammatory Processes.—Beside the degenerative processes just spoken of, true inflammatory affections of the cardiac muscle occur, generally associated with an endocarditis or pericarditis. Occasionally, however, primary affections of the heart muscle are seen, independent of endocardial and pericardial changes; this rare condition is most frequently observed in the course of a rheumatic polyarthritis (in 10 to 15 per cent. of cases), in diphtheria (in 10 to 20 per cent.), in typhoid fever, scarlet fever, small-pox, gonorrhea, and rarely in measles.

The prognosis of this myocarditis developing during the height of disease is dependent on the course of the primary affection.

The postinfectious myocarditis in diphtheria is very dangerous. The chronic, inflammatory affection of the myocardium leads to induration, and owing to the greatly reduced resistance of the cardiac wall, to the formation of cardiac aneurysm. A peculiar form of myocarditis which may follow acute and chronic diseases and lead to injury of the heart, is the so-called fragmentation of the myocardium, the "myocardite segmentaire" of the French. It consists in a transverse rupture of the muscle fibers, especially those of the papillary muscles (Ostreich). One finds in induration myocarditis, the signs of cardiac insufficiency and occasionally a very pronounced bradycardia and arrhythmia. It may be mentioned that syphilitic diseases of the myocardium occur.

In regard to the localization of the myocarditis, a similar behavior is to be observed in diseases of the myocardium and in diseases of the valves. Intrauterine valvular diseases affect generally the right heart, while valvular changes acquired postpartum pertain chiefly to the left heart. The same is true of myocarditis, being localized in the right ventricle if developed *in utero*, and in the left if developed later.

In regard to the symptoms of myocarditis and their treatment, we should only repeat what has been said above. The increased cardiac activity demands strict rest, avoidance of every kind of exertion and excitement, and the application of Leiter's cooling apparatus; if a tendency to palpitation exists, all substances exciting cardiac activity,

as coffee, tea, tobacco, ought to be avoided. Where cardiac weakness dominates the aspect of the symptoms, heart tonics will have to be given. These are, however, not followed by the excellent results which we are accustomed to see in uncompensated mitral lesions.

Some authors speak against the administration of digitalis in diseases of the heart muscle. Romberg emphasizes that in this respect no difference exists between uncompensated valvular lesions and affections of the cardiac muscle, but that in myodegeneration, even after the administration of digitalis, the total power of the heart remains insufficient. The best results in severe cases he has seen, however, from digalen.

V. Diseases of the Pericardium

Pericarditis.—The cardiac disorders in the course of pericarditis may be explained by the participation of the cardiac musculature in the inflammatory process of its serous covering or in cases with large exudate, by the hindrance to the filling of the ventricle during diastole ("Herztamponade"). Further, irritation of the vagus may be present, either from pressure or from participation of the nerve itself in the inflammatory process. The pulmonary veins are the first to be affected by pressure from the pericardial exudate, causing increased blood pressure in the lungs. The pulse in pericarditis is usually very small and soft and, even in the beginning, very frequent, every movement of the patient, even his sitting up, being sufficient to increase further the tachycardia.

The signs of pericarditis on physical examination, such as the inward displacement of the apex beat into the region of cardiac dulness, the helmet-like form of the dulness, the disappearance of the cardiohepatic angle, the absence of the apex beat, and, above all, the presence of pericardial friction sounds, are all well-known symptoms whose detailed discussion is not the object of this book.

In regard to the treatment of pericarditis, whatever its nature, absolute rest is a condition *sine qua non*. Sudden death has been observed not so infrequently, following a quick movement or from sitting up too suddenly. Locally we will apply to advantage Leiter's cooling apparatus or Priessnitz's fomentation or sometimes warm poultices.

In plethoric individuals a copious blood-letting by means of leeches applied to the anterior wall of the chest will certainly be accompanied with success. The diet shall consist exclusively of liquids, the patient receiving small quantities of milk at short intervals. If we suspect the pericarditis to be of rheumatic nature, salicylic preparations are to be given; in those cases where the function of the heart is en-

dangered to a high degree, digitalis and strophanthus have to be tried. v. Schroetter warmly recommends quinin in doses up to 1 gm. daily, if the pulse is irregular. English physicians advise tincture of aconite as a cardiac sedative, 5 to 8 drops three times daily, or 1 drop every hour under careful control (Sydney Ringer).

If the cardiac diastole is threatened by the rapid increase of the exudate we must proceed at once to puncture the pericardial sac. The technique is described completely in another place. The result is usually the immediate relief of the heart. Cyanosis and dyspnea diminish, diuresis increases, the edematous swelling recedes, and if digitalis is now given much better results are obtained than if given without puncture. Puncture, then, is indicated when dyspnea renders life intolerable for the patient, when orthopnea exists, and when the pulse is intermittent during inspiration, a symptom in earlier times considered of almost pathognomonic value (pulsus in spiratione intermittens).

To decrease the discomfort in cases where no indication for operative intervention exists, sodium bromid is valuable; and small doses of morphin may be given without hesitancy. If the disease has reached its acme, the progress of the exudate ceasing or taking a very chronic course, the administration of diuretics may be advantageous. As long, however, as the exudate increases, they are of no use. The treatment will be the same as in pleurisy. If the exudate is purulent or putrid, pericardiotomy must take the place of the simple paracentesis. Delorme and Mignon advise the resection of the fifth and sixth costal cartilages.

Hydropericardium.—Hydropericardium is usually found as the terminal manifestation in the development of a severe general dropsy. Since it occurs in conditions which lead to dilatation of the heart, we must bear in mind that also the enormously dilated right auricle may simulate such a hydrops of the pericardium (v. Schrötter). An exploratory puncture with a very fine needle ought therefore to precede each puncture, the performance of which may be a vital necessity.

Pneumopericardium.—Pneumopericardium is a rare ailment, developing from trauma of the pericardium or from an abnormal communication with an air-containing organ, as, for instance, the stomach or pulmonary cavity. In this condition the cardiac dulness is absent, the stem-pleximeter phenomenon is found, and the cardiac sounds may be metallic and ringing. Severe cardiac weakness is present.

The diagnosis is only possible by consideration of the etiology, since metallic tinkling may also arise from inflation of the stomach with gas. In rare cases also putrefaction may lead to the production

of gas. The prognosis on account of the severe primary disease will be unfavorable; still in cases in which the primary disease has permitted recovery, the healing process has originated from a pericardiotomy.

Concretio-pericardii cum Corde. (*Adherent Pericardium*).—Adherent pericardium has been discussed in another place more in detail. Beside the usual therapeutical measures for regulating and strengthening the cardiac action, the administration of quinin sometimes gives quite good results. In recent times, cardiolysis, recommended by Brauer, gives considerable and lasting relief. The bony parts of the thoracic cage lying over the region of the heart are resected, but the membranous adhesions are left unchanged, and thus the heart is freed from the work of overcoming the elastic traction of the thoracic wall at each systole.

In order to prevent the formation of pericardial adhesions it is necessary to strengthen the cardiac action, as, for instance, by the use of digitalis, whereby the formation of rigid connective tissue between the visceral and pleural layers of the pericardium is prevented.

VI. Palpitation of the Heart

Palpitation of the heart, that is, subjective perception of the heart action accompanied by discomfort, is found in beginning compensatory disturbances and in all conditions of deficient cardiac power. Even in the normal condition of the heart we hear complaints of palpitation if the demands on the heart are abnormally great and its reserve power has been nearly exhausted. Palpitation following excessive bicycling and other gymnastic overexertion, especially mountain climbing, finds its explanation here; in mountain climbing, in addition to the overexertion, the thin atmosphere, poor in oxygen, furnishes another deleterious factor. On the other hand, palpitation may be the expression of a purely nervous process, the normal action of the heart becoming perceptible through an abnormal condition of the cerebral cortex; the action may be entirely normal in the beginning, but later, from the anxiety which accompanies the feeling of palpitation, it may undergo changes, as the animal experiment shows.

The treatment of palpitation depends on its pathogenesis. If abnormal physical exertion as a result of insufficient training or in an individual of tubercular habitus with paralytic thorax or congenital narrowing of the vascular system, has brought about the palpitation, the patient must be placed in a position with the upper portion of the body elevated and must be kept absolutely quiet. Leiter's cooling apparatus, a hot-water bag, or mustard paste should be placed over the cardiac region and cardiac tonics of rapid action, as ether and camphor, should be given freely internally.

If we have reason to suspect a beginning compensatory disorder we will keep the patient in bed for several days, and if necessary put him on digitalis. In light cases, especially in the palpitation of neurasthenics, valerian or sodium bromid will have a sedative effect on the cardiac action.

In the nervous forms the recognition of the primary cause is of chief importance. Abuse of tobacco and coffee, together with mental strain, three conditions often found together in candidates for examinations, are the principal factors. Rest of body and mind, as well as abstinence from tobacco and all foods stimulating to the heart, as coffee and tea, are the first duties of the patient.

Sometimes it is an anemia, in other cases a digestive disturbance, intestinal parasites, or the constitutional anomaly known as plethora vera which give rise to this disturbance. Against the anemia quinin and iron preparations are best given, in the combination, for instance, of ferri et quininæ c tras; also other tonics, as hypophosphites of Fellow and the compound kola syrup of Hell may be given.

In plethoric persons cathartics or enemas may be of service, and the systematic use of bitter waters will show good results. In the nervous forms of palpitation it is of highest importance to convince the patient that his trouble is of no significance. This will be best accomplished by permitting him physical exercise, which, as he himself knows, would commonly be forbidden to patients with organic heart disease. The methodical mechanotherapy which Oertel has inaugurated for organic affections of the heart are not beneficial in this ailment, probably because the too intense occupation of the patient with his condition, inevitable in such a cure, reacts unfavorably on the mental condition and health of the patient. A mild mountain climate combined with a moderate cold-water treatment is often of remarkable benefit.

VII. Paroxysmal Tachycardia

By paroxysmal tachycardia we designate a tachycardia beginning with sudden attacks which may last only a few minutes, but also for several days or weeks. The pulse frequently reaches the highest figures, often 200 per minute or more. In the attack itself the heart is usually dilated, but without doubt paroxysmal tachycardia may exist with no dilatation of the heart. The same is true of the pulse. Usually it is very small and of low tension, in rare cases, however, the good tension of the pulse is striking. During the attack the patient has a sensation of oppression, he looks prostrated, and the weakness of the heart may be recognized by the cyanosis of the extremities, the enlargement of the liver, the changes in the urine

and the dropsy—this chiefly in attacks of longer duration. In some cases the patients do not suffer at all subjectively, and their capacity for work is not much impaired. These attacks are often found in patients who in the intervals impress us as entirely healthy in regard to their circulatory as well as to their nervous system. In other cases paroxysmal tachycardia is a symptom of pronounced cardiac changes; these may be in the valvular apparatus or in the myocardium, or they may be due to a toxic injury to the heart, as in diphtheria.

The exciting factor in the attack may be insignificant. Muscular exertion, mental excitement, and slight indispositions are in the mind of the patient connected with the attack, which is directly brought about through relaxation of the heart power (Krehl). In some cases a connection with the vagus, the cardioinhibitory nerve, may be demonstrated by the following experiment. If in such patients pressure is exerted on the vagus nerve the tachycardial seizure may be instantly stopped. It is, however, not at all certain that all cases of paroxysmal tachycardia may be explained in the same way, as we are certainly not justified in regarding it as a simple neurosis of the vagus.

Nevertheless, in the treatment, the experiment just described will be tried, to check the paroxysm by pressure on the cervical vagus. If this fails we may try to influence the vagus through galvanization; sometimes a stimulus on the neck by means of cold gives excellent results, best accomplished by means of the ethyl chlorid spray. Also the valerianate of zinc in doses of 0.05 gm. three times daily is sometimes efficacious. In cases in which anxiety is the predominant symptom in the attack, sodium bromid or an injection of morphin will have the desired effect. The obvious conception that digitalis would slow the heart is in a great number of cases fallacious. But when the dilatation of the heart and the softness of the pulse speak for severe injury of the heart, then we will make use of digitalis and the other cardiac tonics. As a prophylactic measure against recurrence CO_2 baths and sodium iodid internally are recommended.

ARTERIOSCLEROSIS

Arteriosclerosis is a disease so polymorphous in its symptoms that it is impossible here to deal with its clinical picture in detail. Only the essentials of the treatment will be mentioned, which may prevent the dangerous aspect of a paralyzed heart, so common in the course of this disease. The *indicatio-causalis* in arteriosclerosis also ought to be met. Arteriosclerosis is the disease of wear, and all that acts injuriously on the vessels during life, occasionally manifests itself at a later age as a cause of arteriosclerosis. The

principal factors which hasten the appearance of arteriosclerosis are the abuse of alcohol and tobacco, immoderate bodily exertion, mental irritation, constitutional anomalies, as obesity, diabetes, gout, and intoxications, especially lead.

The understanding of arteriosclerosis has been improved by the finding of Taussk, that the senile heart possesses almost no reserve power and therefore is unable to satisfy even normal demands.

The régime of arteriosclerotic individuals must be conducted along lines reducing the blood pressure. Milk and milk foods have to be taken abundantly and a vegetable diet should take the place of meat. In this way the patient may be freed from constipation, so injurious to this ailment. It is a known fact that persons of more advanced age feel well only if they have their regular bowel movement and that they complain of discomfort of all kinds if this function is disturbed. It appears that old arteriosclerotic individuals are much more sensitive in this regard than those younger.

In order to avoid any rise of blood pressure the patient should be exposed neither to excessive heat nor cold; should not be allowed hot or cold baths and should be warned against hot and cold drinks. Through mild hydriotic measures, through washing and rubbing of the skin, the cutaneous vascular net becomes dilated and in this way the blood pressure decreased. The same thing may be accomplished by general massage of the body. Very often the arteriosclerotic contracted kidney is associated with general arteriosclerosis, and the renal excretion is more or less disturbed. For this reason, it is advisable to use diuretics in small doses over a long period of time, as, for instance, diuretin. Huchard recommends, for the treatment of arteriosclerosis, sodium iodid, which may be prescribed in pills or in aqueous solution. The daily dose should not exceed 2 gm. and in this way should be given for a few weeks, then interrupted for some weeks, and this repeated several times. On account of its cumulative action, it is advisable not to give it continuously, but to make a pause of three days after it has been administered for four or five days, if signs of iodism appear.

According to Müller and Inada, sodium iodate does not act on the blood-vessels, but on the blood itself, whose inner friction and viscosity are decreased. It is therefore especially effective in cases of insufficient blood supply in an organ and finds its application in cerebral arteriosclerosis, in light forms of angina pectoris, in moderate degrees of cardiac weakness, and cardiac asthenia.

The theoretically constructed treatment of Rumpf, to check the arteriosclerosis by the reduction of lime in the food and to give lactic acid in order to dissolve the lime in the blood-vessels, has failed to show practical results.

There exist a number of drugs which considerably decrease the blood pressure, as amyl nitrite, sodium nitrite, and nitroglycerin. But the resulting fall of blood pressure, though very pronounced, is very transient, and in such a chronic disease as arteriosclerosis one cannot expect great results from the use of these drugs. In arteriosclerotic individuals, however, we must be prepared for different complications which may result from the local atheromatous changes. Atheroma of the cerebral vessels may lead not only to true apoplectic strokes, but also to lesser circulatory disturbances in the brain, characterized by vertigo and headache usually localized in the parietal region, and occasionally by transient fainting spells and sudden aphasia. The appearance of these symptoms demand absolute rest in bed. According to the pale or to the turgid aspect of the face, one will lower or raise the head and trunk, give attention to the bowel movements, and try to improve the cardiac force through digitalis or strophanthus. Occasionally one finds retrosternal pains in arteriosclerosis, which very probably are connected with pathological changes in the big vessels. In such cases the patient must be put to bed, a cooling apparatus applied over the region of the heart or strong counterirritants over the sternum in the form of a mustard plaster or cupping glasses.

AORTIC ANEURYSM

Of all diseases of the blood-vessels, aneurysms are the most dangerous; they threaten life in two ways: by erosion of the wall causing fatal hemorrhage and by pressure on vital organs. Thus aortic aneurysm may produce the severest symptoms by pressure on the esophagus, on the trachea, on the pulmonary artery, the superior vena cava, and the thoracic duct. The first symptom of compression in subjects of aneurysm is usually cyanosis. Aside from compression, these patients may die of an intercurrent disease, which may have a causal connection with the primary disease causing the aneurysm; thus patients may die from the sequelæ of arteriosclerosis or syphilis localized in the cerebral vessels.

In regard to the influence of aortic aneurysm on the heart, Skoda has already stated that the heart may be entirely normal in its dimensions and position. Those changes found occasionally in the myocardium with coexisting aortic aneurysm are not necessarily caused by it, but may have a pathogenesis in common with the aneurysm.

Only in those cases where the aneurysm has already reached considerable dimensions will the left ventricle in all probability be hypertrophied. In this hypertrophy itself there lies the farther danger, that the heart may give way in the end, and this may be

hastened through degenerative changes in the myocardium or through coronary sclerosis.

In regard to the pulse in aortic aneurysm, formerly great weight was placed on its retardation on that side on which the vessel departs from the aneurysmal sac. v. Schrötter emphasizes, however, that often no conspicuous difference in the pulse can be found, and that occasionally a coexisting arteriosclerosis may obscure this phenomenon. Thus it may occur that the pulse is smaller and retarded on that side where we should not expect it.

Diagnosis.—The diagnosis of aortic aneurysm is not always to be made with certainty. We find, sometimes, postmortem aneurysms whose diagnosis was not possible *intra vitam*, and occasionally a fatal hemorrhage may be the first manifestation of an occult aneurysm. In recent times radioscopy has enabled us to recognize aneurysms which formerly could not have been diagnosed.

Symptoms.—One of the most important symptoms which points to aortic aneurysm is pain localized along the intercostal nerves or radiating into the extremities. The left recurrent nerve of the vagus is impaired in its function when the aortic arch bulges on its concave side; but also aneurysm of the ascending aorta leads to paresis of the recurrent nerve on the left side rather than on the right, since the right recurrent winds round the right subclavian artery. If the patient complains of pain and is conspicuous for his hoarse voice (vox anserina), we must first determine if paresis of the recurrens exists. This gives a valuable hint as to the presence of aneurysm. In rare cases the vagus itself may be compressed and the condition may be responsible for the frequent tendency to vomiting; in other cases irritation of the pupillo-dilator fibers of the sympathetic nerve produces anisocoria, and compression of the phrenic nerve may cause distressing singultus.

The change in the voice is sometimes associated with a certain stridor which indicates not only involvement of the recurrent nerve, but compression of the trachea or of a principal bronchus at least.

Therapy of Aortic Aneurysm.—The prophylaxis of aneurysm is comprised in the treatment and prophylaxis of those primary diseases to which it owes its origin. We will first of all introduce measures to check the progress of arteriosclerosis, and in case of syphilis give specific treatment, since doubtless a great number of aneurysms develop on the basis of syphilitic vascular changes.

In regard to the treatment, it would be desirable to have a method to increase the coagulation of the blood. The older methods of injecting chemical agents into the sac have been justly abandoned, for the coagula produced in this way are not parietal and may at once be transported with the blood-stream, causing fatal embolism.

Through careful avoidance of every muscular exertion we may in rare cases induce the organization of the thrombus, but any sudden rise in bed may be sufficient to force the thrombus into the blood-stream. The chief requirement for the successful treatment is absolute rest; everything stimulating cardiac action must be avoided. In earlier days it was customary to bleed the patient for aortic aneurysm. This method was so misused that it came into discredit, but at present it is again recommended, if done with great precaution. Pressure symptoms, as paresis of the recurrens or neuralgia often recede with surprising rapidity after venesection.

Beside physical and mental rest, all means are to be employed to prevent any rise of blood pressure, and therefore an abundant supply of liquid has to be forbidden, and even the necessary intake of food and drink has to be reduced to a minimum. One will, of course, have to observe the physical condition of the patient, and if bad nourishment and anemia dominate the aspect of the disease, care for improved hematopoiesis shall be the first indication. Very important is the care of the bowels, especially in aneurysm of the abdominal aorta. Any constipation is disadvantageous to the condition of the patient, subject to thoracic aneurysm.

Beside these general measures the local influences on aneurysm have to be considered which, too, aim to accomplish the formation of thrombi. Long ago Velpeau recommended the insertion of needles to produce the precipitating of fibrin in the aneurysmal sac, the so-called acupuncture. The effect of this process may be increased by heating the needles from the outside after their insertion or by conducting a galvanic stream through the aneurysmal sac, using the needles as electrodes. Still others have recommended the introduction of only one needle into the sac, using it as the anode. The development of gas, which leads to the appearance of hydrogen at the cathode, is less desirable in the blood-stream than at the anode, where the bubbles of oxygen are either absorbed by the blood or oxidize the metal of the needle; in this way the gas disappears from the blood. If gas bubbles are present in a blood coagulum it becomes spongy and therefore less easily organized. Stewart recommends the application of a large flat electrode as cathode on the thorax and the introduction of the needle as anode into the aneurysmal sac, the stream being gradually increased to 20 ma. or more. The treatment may last for half an hour. This method is used more frequently in France, England, and Italy, more rarely in Germany. The results are scarcely entirely satisfactory. Temporary improvement, however, is often seen, embolism having been reported only in a single instance (Ch. Baumler). The attempt has often been made in different ways to induce the formation of clots: watch springs (Baccelli), horse-hair,

silk threads, etc., have been introduced. Baumler thinks the best results are obtained by the method of Macewen, in which needles are introduced, hot, as foreign bodies, to produce coagulation, with the object of producing lesions of the vascular endothelium by scratching the wall with the point of the needle or by the movements which the needle makes in the blood-stream. For it is a well-known fact that coagulation occurs when the intima has lost its intact cellular layer. Brasdor tried to retard the blood-stream in the aneurysmal sac by ligating the common carotid, the subclavian, or both. Barwell emphasizes, however, that any operative procedures have to be abandoned if a high degree of cardiac hypertrophy, a severe valvular lesion or arteriosclerosis exists, or if the aneurysm has reached too large a size. Aneurysm of the innominate artery offers better chances of success for this operation. Analogous to ligation is the action of digital compression, which may be exerted on the peripheral side of the aneurysm, if it is not possible to do it between the heart and the aneurysm, which is impossible in aneurysms of the ascending aorta or of the arch. If we have to deal with an abdominal aneurysm, then central compression is possible, although not without danger, for it is technically impossible to compress the aorta without at the same time exerting severe pressure on those organs lying between the aorta and the anterior abdominal wall, as the intestines, the pancreas, and the solar plexus. Compression of the abdominal aorta may be exerted only until the peripheral pulse is no more palpable, and must not be continued for more than a few hours. Ligation of the abdominal aorta on the distal side of the aneurysm threatens the lower extremities with gangrene. Jacobsthal, on the other hand, announces favorable results if, in aneurysm of the ascending aorta, the right subclavian and carotid arteries are ligated; in aneurysm of the arch the same vessels are ligated on the left side.

Lancereaux and Huchard have recommended subcutaneous injections of gelatin to induce thrombus formation. Fifty cubic centimeters of Merck's sterile 10 per cent. gelatin solution are injected every eight to ten days at first, every two to three days later on. Fifteen to thirty-two injections will be necessary to accomplish results.

All these methods have, however, only historical value, having been abandoned in the present treatment of aneurysm.

The use of astringents, formerly so much in favor in the medicinal treatment of aneurysm, has been entirely abandoned and also ergotin, in whose vasoconstriction action Langenbeck placed such great confidence, is no longer in use. Ergotin, as is known, contracts the blood-vessels, and in this way increases the blood pressure. All the vessels in the periphery become contracted, while the aneu-

rysmal sac alone, which has no muscular envelope, remains relaxed, and with the resulting rise of blood pressure only harmful effects can be expected. Sodium iodid is most commonly given, to it being ascribed a favorable action on the diseased wall of the vessel, especially if the changes are of luetic nature.

In the symptomatic treatment the common antineuralgics are given for the pain and morphin is withheld as long as possible, so that this valuable remedy may not fail when the suffering reaches its last agonizing stage. If the pain is localized in the aneurysmal sac itself, relief may be given by the local application of cold and sometimes by a supporting bandage. Such a support is indicated in threatening rupture of the sac externally.

In plethoric patients with high-pressure pulse a venesection may have a favorable influence on the pain through the resulting fall of blood pressure.

Some patients suffer from severe dyspnea caused by pressure on the vagus nerve, on the trachea, or on the phrenic nerve with paresis of the diaphragm. The nervous manifestations may be combated by electrotherapy. When dyspnea is due to pressure on the trachea, often only tracheotomy can save life, and this only provided that the point of pressure does not lie too deep. The tracheotomy should be made as deep as possible and a long cannula introduced.

The treatment of aneurysmal hemorrhage will be discussed at another place in the book.

The diagnosis of intracranial aneurysm cannot be made with certainty. It may, however, be suspected if, with symptoms of brain tumor, vascular murmurs may be heard on the head. A. Hecht had occasion to observe the case of a seven-year-old girl in whom, after trauma, a pulsating tumor could be palpated on the top of the skull; a loud vascular bruit could be heard over it. Puzey advises in such cases ligation of the common carotid, but the influence of pressure on the aneurysm will first have to be tested. Of the internal remedies sodium iodid should be tried first.

THE HEART IN RESPIRATORY DISEASES

Pneumonia.—Considering the disorders of the heart in the course of a pneumonia, we may mention that the pneumococcal infection may sometimes produce endocarditis, and that some heart failures develop on the ground of such a diplococcal endocarditis. Much commoner than this affection of the heart, however, is the injury of the cardiac power by toxins produced by the germs of pneumonia. The relation between the local manifestations (culminating in the

diminution of the respiratory surface) and the general symptoms, is not always the same. Some pneumonias, involving such a small area that it is only detected very late, may present the appearance of the most severe toxemia. In other extensive pneumonias the elimination of a great part of the respiratory surface in itself explains the disturbances on the part of the circulatory organs.

The pulse in pneumonia is usually very frequent; in general the rule holds that very high pulse counts are of very unfavorable significance in those cases where, not existing from the beginning, they develop suddenly later on in the course of the disease. In pneumonia in children, however, a high pulse count does not mean as much as in adults; the younger the child, the less one needs to worry about the high pulse. For adults, Griesinger regarded a pulse of 120 as quite serious, but in fact this rate is present in almost all pneumonias, and only higher counts are to be considered as a dangerous symptom; in a child of three to four years a pulse of 140 is of itself not a life-threatening symptom.

It is quite different with the irregularity of the pulse. If, at the height of the disease, the pulse becomes irregular, this has to be considered as a sign of severe cardiac weakness, but not if it occurs after crisis. In the defervescence, bradycardia develops in pneumonia, as in many other infectious diseases; if this is very pronounced (there may occasionally in adults be only 40 pulse beats a minute) it is usually associated with arrhythmia. Finkler has called attention to the fact that the pulse may become slow just before the crisis occurs, and that this symptom often gives warning of the approach of crisis.

As signs of a moderate degree of cardiac weakness, dicrotism, sometimes gallop rhythm and embryocardia are to be found during the disease and after the fever.

A slight degree of dilatation of the heart is frequently observed in the course of pneumonia. It may be due to the impaired respiration or to changes in the cardiac tissue.

A displacement of the heart may be found not only in pleuritic exudates, but also, exceptionally, if some lobes of the lungs, in the state of hepatization, protrude considerably, the infiltration being immediately adjacent to the heart. The explanation of this is not that the hepatized portion of the lung shoves the heart away, but that the negative pressure on this side is absent and thus the heart is drawn toward the side of the healthy lung.

Collapse may occur in pneumonia during very high fever; the pulse is very small and frequent, often arrhythmic, the internal temperature is very high, the peripheral portions of the body, nevertheless, from the circulatory disturbance, are cold, the skin livid and mottled. This "areolar cyanosis" is rightly considered as a sign of bad prognosis.

In this form of collapse sweating is entirely absent. Collapse may also occur after defervescence, and in rare cases just at the defervescence. The pulse frequency may sink to forty beats a minute. The patient feels greatly depressed, he is covered with a cold sweat, and may become delirious and pick at the bed clothes. This form of collapse is generally found in the pneumonia of alcoholics, developing in the course of delirium tremens, and also in senile and marantic individuals. In general, the rule holds that the later the collapse appears the more dangerous it is.

Very pronounced cyanosis is found in the course of pneumonia, chiefly in those cases where the heart has not been healthy previously, in aspiration pneumonia, in all secondary inflammations of the lungs, as for instance following intoxication with CO_2 gas, and in complications as in endocarditis, pericarditis, mediastinitis, thyroiditis, malaria, and diabetes. The pneumonia of diabetic patients leads, with severe cyanosis, to coma and death, while in the true diabetic coma cyanosis is never seen, although the respiration is dyspneic (v. Neusser).

The frequency of the pulse in croupous pneumonia of children is somewhat less than in bronchopneumonia, which altogether has to be considered as the much more dangerous form. The increased frequency of the pulse in pneumonia scarcely reaches such a degree as in acute and subacute miliary tuberculosis. Beside the cardiac weakness, the peripheral vascular system is responsible for the circulatory disturbances in pneumonia. The fall of the blood pressure, best observed through auscultation of the second aortic sound, is due perhaps rather to the giving way of the "peripheral heart" than to the injury of the heart muscle itself; yet, lately, Alb. Frankel has explained the death in pneumonia as a true "heart death."

Sir Isambard Owen described in croupous pneumonia the occurrence of primary edema of the lung which leads to secondary cardiac weakness, advocating in such cases strychnin injections and bloodletting.

In regard to the treatment of the heart, everything which could weaken its force must be avoided. Venesection, formerly so much in use, has rightly been entirely abandoned, and we can only be astonished that it dominated so long in the treatment of pneumonia. Of medical means quinin still merits our greatest confidence. Adults receive one dose of 2 gm. in the evening between six and eight o'clock; children 0.1 to 0.2 gm. for each year of life, but not more than 1 gm. shall be given to children under ten years. Between the administration of any two doses forty-eight hours should intervene. Jurgensen warns us against the continual use of quinin, and in cases of digestive disorders following its use, he recommends it in the form of enemas.

Rp. Chinin. bisulfur., 2.0
Tinctur. opii simpl., gtt. Nr. X.
Decoct. alth., q. s. ad solutionem.
DS. For one enema.

For strengthening the heart action digitalis is recommended eventually combined with liquor ammonii anisatus or caffein. Subjects of chronic alcoholism usually endure the administration of digitalis by the mouth very badly. Digalen injections will be the best substitute.

The fear of injury to the heart from the use of morphin in pneumonia is not justified. Of course, in old decrepit individuals, in asthenic pneumonia, and in tendency to somnolence, we will abstain from its use. But if vigorous patients suffer from severe dyspnea or great pain, one will not hesitate to give relief by a dose of morphin, the more since a refreshing sleep can certainly only increase the strength of the patient. A. Pick has, in regard to the cardiac force, obtained very good results from the hydriatic treatment in pneumonia, in its croupous as well as its catarrhal form, and in a number of influenza pneumonias which are so much dreaded. Baths of 24° C. gradually cooled down to 22° are given for eight to ten minutes combined with short vigorous douches on the neck. The antipyretic effect is a very small one, but the chief result of the bath consists in a very marked improvement in the tension of the pulse and in the decrease of the pulse rate.

In those cases where any great movement on the part of the patient does not seem desirable, as in extensive infiltrations, severe dyspnea, and threatening cardiac weakness, baths restricted to a part of the body are given. This partial bathing may be substituted entirely for the full bath, even though contraindications are not present.

The partial bathing, to a certain degree, may be of service in making the prognosis. When we do not succeed through friction in producing a glow and warmth in the skin, when the members remain cold and mottled, though the rectal temperature is high, the prognosis will be unfavorable, and owing to the absence of reaction on the part of the vascular system, we can expect no results from the hydriatic procedures. Camphor and alcohol must be tried in these cases, and if, by these means, the circulatory disturbance has been overcome, one may very cautiously again start with the partial bathing.

In children the mustard bath and the mustard packs are of great value for the improvement of the heart power. The action of the vascular system toward these therapeutical measures gives some valuable help in prognosis. A child that lies for ten minutes in such a pack with no resulting redness of the skin, can scarcely be saved by

any analeptics; we will try, however, to combat the collapse with ether and camphor injections.

Atelectasis in the New-born.—Atelectasis of the new-born generally does not exert any marked influence on the heart action; at most the heart may be somewhat feeble, its sounds somewhat dull, but usually neither acceleration nor retardation of the pulse is observed. But when the atelectasis is very extensive and the respiration very superficial, the pulse is generally very small and frequent and the right heart overfilled with blood, leading to severe congestion of the liver, and later on to edema.

Emphysema.—In substantial emphysema of the lung we have at first to deal with an obliteration of some portions of the capillary system; then, as a very important factor in the injury to circulation, comes the insufficient expansion of the thorax, leading to insufficient aspiration of the venous blood to the heart. There results hypertrophy of the right ventricle, and, in the farther course of the disease, degeneration of the myocardium.

The demonstration of cardiac changes in emphysema is quite difficult. The heart is covered by the lungs and the patients are frequently corpulent, making it rather difficult to palpate the apex beat. If it is palpable it lies outside the absolute heart dullness, and the sounds are very dull owing to the unfavorable means of conduction, and the remote position of the heart. So it may happen that for a long time we are uncertain as to the condition of the heart; at most the small, weak, somewhat accelerated, sometimes irregular pulse, may point to a certain feebleness of the heart action. Then suddenly severe manifestations may appear, the veins of the neck become strongly filled, the liver swells and becomes painful on pressure, symptoms of hydrops develop, and the positive venous pulse in the neck and the positive pulse of the liver render the diagnosis of tricuspid insufficiency due to dilatation of the right ventricle unquestionable.

The treatment of the condition will be the same in the beginning as that used successfully in uncompensated heart lesions; patients have to observe absolute rest in bed, the supply of liquids has to be restricted as much as possible, and cardiac tonics, above all digitalis, must be tried. As soon as the patient has again reached a state of compensation we should aim to improve the primary disease as far as possible, or at least to prevent its getting worse. The bronchitis is treated with inhalations or expectorants, and sometimes the respiratory gymnastics and climatic treatment, or the use of pneumatic chambers, described at another place, will render good service.

Miliary Tuberculosis.—In regard to tuberculosis we have first to speak of the miliary form, which, according to Cornet, shows a frequency of pulse exceeding the normal parallelism between pulse and

temperature. Pulse beats of 120 to 150 in a minute are quite common. When, therefore, we find in miliary tuberculosis a retardation of the pulse we must think of a dissemination of miliary tubercles on the base of the brain. The pulse in miliary tuberculosis shows dicrotism much less frequently than in typhoid fever.

Chronic Tuberculosis of the Lungs.—In chronic pulmonary tuberculosis the pulse is usually accelerated, though no fever exists, even in the first stage of the disease; in 85 per cent. of cases Foss found some degree of cardiac weakness and paradoxical pulse.

Turban in Davos believes that high pulse-counts in general, but especially at the beginning of the disease, permit us to assume with a certain probability an unfavorable course of the disease, and he explains this behavior by the lowered resistance against the cardio-accelerating toxins of the tubercle bacillus. He includes those cases in which, soon after their arrival at the high altitude, the initial high-pulse frequency again decreases, and considers the tachycardia in these cases as the reaction of the organism to the climatic conditions of the high altitude.

Especially conspicuous is the high pulse count in the evening after rich meals. Moreover, a certain lability of the pulse may be observed, the count rising and falling very quickly, after physical exertions and psychical emotions.

In severe cases delirium cordis may develop, the pulse being rapid, easily compressible, and very irregular.

It must also not be forgotten that, in ulcerative phthisis, endocarditis is a frequent sequela, giving almost no clinical symptoms. Cyanosis, in bronchiectatic cavities, is usually very marked, due to the coexisting emphysema.

Pleurisy.—The frequency of cardiac action is increased in pleurisy through the diminution of the respiratory surface. This symptom may be explained as a compensatory process. The acceleration of the pulse becomes very marked on exertion, and then not only the pulse may show a very high frequency, 140 or more beats in the minute, but also the filling of the arteries may be markedly decreased. Beside the restriction of the respiratory surface, a very copious exudate in the course of a pleurisy may bring about still other disorders of circulation. The compression of the superior vena cava may render the venous flow to the heart difficult, leading to stasis in the region of this vein, and so to swelling of the cervical veins. If the venous flow during inspiration suffers still farther hindrance, the pulsus paradoxus may appear.

If the outflow of venous blood from the cranial cavity is obstructed, we find in the place of acceleration, a retardation of the pulse through irritation of the vagus or stimulation of the cardiac muscle itself,

and at the same time arrhythmia and narrowing of the arterial lumen, a symptom which is perhaps to be explained by the bad blood supply to the heart through compression of the venæ cavæ. In other cases the pulse is, from the beginning, somewhat retarded, the artery being exceedingly soft. This, too, may be a compensatory process, the heart, as sometimes in mitral stenosis, providing a sufficient diastolic filling before each systole. This may generally be considered as a favorable symptom, occurring only when the strength of the heart is good.

From what has just been said it results that the condition of the heart in pleurisy has to be watched very carefully in order that we may be prepared for sudden accidents, as collapse of the heart, which does not occur seldom in copious pleural exudates of the left side; compression and displacement of the heart and kinking of the great vessels may be the cause.

The therapeutic indications of pleurisy will always depend on the condition of the heart. Thoracocentesis is conditioned by the force of the heart and the degree of its displacement; that is, if the exudate is increasing one will rather wait with the puncture if symptoms on the part of the heart do not indicate an earlier intervention. In subjects of heart disease one will, of course, puncture earlier than in the case of healthy hearts. Also, in internal medication, the condition of the cardiac force will have to be considered; sometimes, if the pulse is small and frequent, we see surprisingly good results from digitalis medication.

Even more than in that of adults, in the pleurisy of children the tendency of the pulse to great fluctuations is conspicuous (Rosenbach).

Pneumothorax.—In regard to the manifestations on the part of the heart in pneumothorax, the apex beat is seldom found in its normal location. It is displaced or entirely absent, and therefore cannot be used as a measure of the cardiac force; thus we are limited exclusively to the examination of the pulse in forming our judgment of the heart force. The onset of pneumothorax is usually announced by the symptoms of severe heart collapse; the pulse becomes small, very frequent and soft, the patient is covered with a cold sweat and the extremities are cold and cyanotic. The manifestations of severe cardiac weakness are especially pronounced in the traumatic form of pneumothorax occurring in full health. In these cases one must be free in the use of rapidly acting analeptics, ether and camphor subcutaneously and alcohol internally.

Abnormally High Position of the Diaphragm.—If meteorism of a high degree develops suddenly and results in pushing up the diaphragm, symptoms of displacement of the heart arise. The apex beat is

palpable in the third or fourth intercostal space external to the mammary line. This latter phenomenon is not the consequence of a dilatation, but the apex beat in the higher position of the diaphragm moves outward because the longitudinal axis of the heart is no longer directed obliquely downward, but assumes a more nearly horizontal position. With this displacement of the heart, disorders arise, combined with disturbances on the part of the lung. The venous flow is hindered, causing cyanosis and swelling of the jugular veins, the bulbi protrude and the pulse is small and very frequent.

THE HEART IN ABDOMINAL AFFECTIONS

Attacks of Colic.—In any ordinary attack of colic we may observe disorders on the part of the circulation, as a small, frequent, irregular pulse, and cool, cyanotic extremities. These are probably reflex phenomena and of little importance, for as soon as the colicky pain decreases, the circulatory disorders usually disappear. Still more pronounced, though transient, is the cardiac weakness during an attack of gall-stone or renal colic.

Peritoneal Affections.—Quite different are the manifestations in diseases of the peritoneum. Even the old physicians knew that abdominal affections led to changes of the pulse and they designated this very soft, easily compressible, but usually regular pulse as pulsus abdominalis. Its frequency is usually high in adults, reaching 120 to 140 beats per minute, and even 180 sometimes. It is very striking in severe septic peritonitis and the previously fairly good pulse changes quite suddenly on perforation of the intestine. In typhoid fever, where usually a relative bradycardia exists, a suddenly appearing high-pulse frequency together with a marked fall of the tension, will make us think at once of an intestinal perforation.

Internal Hemorrhage.—The same phenomenon, however, is also to be observed in intestinal hemorrhage, as well as in all internal hemorrhage in general. The heart action becomes suddenly weak, the extremities cool, the pulse small, easily compressible, and very frequent, as in any collapse. Yet the experienced physician will be led to the right diagnosis by the general aspect of the patient. Very striking in internal hemorrhage is that suddenly appearing pallor of the general integument and mucous membranes which is never quite so marked in the other causes of cardiac weakness. We gain an impression of anemia rather than of cyanosis; at most there may be just a trace of livid discoloration. Very characteristic is the onset of an acute anemia of the brain, a state of syncope, from which the patient may recover even if the hemorrhage continues, provided that the head

is placed low. Of course we will think of internal hemorrhage if we deal with diseases in which this is a common complication, as ulcer of the stomach, typhoid fever, severe hemorrhagic diathesis, and gynecological affections (tubal pregnancy).

Symptom of Mannaberg.—Mannaberg was the first to call attention to the frequent accentuation of the second pulmonic sound in abdominal diseases, especially in perityphlitis. A suggestion of it may be observed normally in the phase of digestion.

Liver Diseases.—In the different liver diseases, disorders of the heart action are common. Occasionally the patients complain of palpitation, of the sensation of oppression. They themselves observe the intermission of the heart beat, and are sometimes subject to peculiar sternocardial attacks. Diseases of the liver produce cardiac disorders when the general strength of the patient is very low and the heart itself has participated in the general emaciation, and in those cases in which an ascites furnishes an obstacle to circulation, through compression of the inferior vena cava. In all cases where this explanation is not satisfactory, we are obliged to assume the formation of toxins which injure the cardiac force, or we must think of reflex influences. So the small branches of the vagosympatheticus, passing through the diaphragm and the suspensory ligament to the liver, may transmit, reflexly, cardiac disorders from the liver.

In liver abscess and other pyogenic processes, changes in the myocardium are quite frequent, leading to dilatation and to an irregular and feeble heart action, sometimes to accessory murmurs. In the first stage of acute yellow atrophy of the liver the heart action is usually retarded, later accelerated, the sounds are dull and soft, occasionally accompanied by a systolic blow. The action of the heart is very similar in phosphorous poisoning, whose relation to acute yellow atrophy is so intimate that the differential diagnosis at postmortem examination is quite difficult.

The hypertrophy of the heart, sometimes observed in Laennec's cirrhosis, was explained by E. Wagner as due to the obliteration of the capillary system in the liver, the same explanation as that given for its occurrence in granular kidney (Quincke, Hoppe-Seyler). But just as the latter hypothesis has been abandoned, so the cardiac changes in Laennec's cirrhosis may also be interpreted in another way. It may be that the manifestations in the two organs are coordinate, the harmful factor, the abuse of alcohol, which led to changes in the liver, having at the same time injured the heart. Thus, first, it comes to dilatation, and then, as a compensatory process, to hypertrophy.

If cirrhosis of the liver has once produced an enormous ascites and cachexia, then the involvement of the heart is readily understood, as

in cancer of the liver in which, besides these symptoms, anemic murmurs may be heard over the heart, as in other cachexias.

Bradycardia in Jaundice.—It is a well-known fact that jaundice leads to bradycardia; the pulse is usually smaller than it is normally. With the decreased pulse rate the temperature may also fall a few tenths of a degree, as Janssen has six times observed in eighteen cases of catarrhal jaundice. This phenomenon is probably due to the action of the biliary salts. Röhrig believes that these salts injure the intracardial ganglia while others consider it more probable that the ends of the vagus are irritated. The fact that through injection of atropin the frequency of the pulse can be markedly increased speaks for the latter conception.

Icterus Neonatorum.—In the jaundice of the new-born this bradycardia is absent, and therefore it was first believed that the bile acids did not pass over into the blood in jaundice of the new-born; but Halberstamm has proved that bile acids may be found in the urine. Also jaundice in older children runs its course without bradycardia. Knopfelmacher believes that the cause of this is the fact that, in children, only small amounts of bile acids are contained in the bile, and Jakubowitsch has found only glycocholic acids in the bile of children, having failed to find taurocholic acid. However, it seems plausible that it is not so much the different action of the bile which explains these manifestations as the low tonus of the vagus in childhood, since also other diseases associated with bradycardia in adults do not show this symptom in early childhood; this is the case with the relative bradycardia in typhoid fever.

Adrenals.—If we consider the importance of the blood pressure increasing substance of the adrenal glands, we shall not be surprised that diseases of the adrenal glands are associated with a pronounced involvement of the cardiac force. In patients with Addison's disease, the heart power is markedly decreased, and this may be the leading factor in producing the chief characteristic of the disease, adynamia. Palpitation, especially following physical exertion, and mental emotion often appear at an early stage of the disease. The cardiac action becomes frequent and irregular; the sounds are soft, the beat very weak, the pulse small and compressible, usually very much accelerated, and only in rare cases does bradycardia exist. Not seldom one hears anemic murmurs over the heart. In those cases in which the patient complains of a vivid pulsation of the abdominal aorta, we have a complication with arteriosclerosis (v. Neusser).

The blood pressure is found almost constantly very low, figures of 35 to 40 mm. mercury (Gärtner's tonometer) being common. Before the end, a very pronounced cyanosis sets in with the progressing cardiac weakness.

THE HEART IN KIDNEY AFFECTIONS

R. Bright, in his illustrious paper, called attention to the association of cardiac changes in renal disease. The investigation of Traube "On the relationship of heart and kidney diseases" brought more light on this question; he excluded those disorders of the renal function following insufficient cardiac action, the engorged kidney from the kidney diseases proper. Hypertrophy of the heart is found not only in granular kidney, as first supposed, but also though not to so marked a degree in the other forms of nephritis, in all chronic and subchronic cases, and indeed in acute nephritis, as Simbson and Friedlander have shown. However, the contracted kidney is that affection which leads with the greatest regularity to cardiac hypertrophy. For the rise of blood pressure is most pronounced in contracted kidney, though it must be conceded that in all other forms of nephritis an increase of blood pressure may develop in the course of the disease, as Riegel has shown in acute nephritis. Here the blood pressure rises before the cardiac hypertrophy could develop, even in those cases in whose later course such a hypertrophy could be found.

The hypertrophy involves both ventricles, or the left alone; the original conception that the hypertrophy in interstitial nephritis involves the left ventricle exclusively has been disproved through the investigations of Bamberger. Senator has shown "that in genuinely contracted kidney the simple hypertrophy of the heart is more common, in the other forms of Bright's disease the eccentric hypertrophy predominates. Passler considers the hypertrophy of the left auricle and of the right ventricle as secondary, caused by insufficiency of the left ventricle. The hypertrophy of the left ventricle he attributes to arterial spasm and high tension caused by the lesion in the kidney. From this he deduces the practical therapeutic conclusion that, beside the strengthening of the heart, our chief aim must be to lower the blood pressure (as through hot brine baths with CO_2). The peripheral system is equally involved, and in chronic nephritis, most frequently in the interstitial form, a very extensive arteriosclerosis exists; also that change in the wall of the small arteries which Gull and Sutton describe as "Arteriocapillary fibrosis." This disease is quite analogous to arteriosclerosis and constantly associated with those changes in the larger vessels which we call arteriosclerosis. Its connection with interstitial nephritis has been much disputed—that is, which of the two processes is to be considered the primary one. Gull and Sutton regard the changes in the vessels as the primary process, since they have found it even in the healthy kidney together with cardiac hypertrophy. Occasionally a hypertrophy of the muscularis of the smaller arteries is found which Ewald regards as a result

of the cardiac hypertrophy. The true causal connection of all these manifestations is still the subject of much controversy, but the fact is clear that cardiac hypertrophy will occur in all cases in which an extensive loss of renal parenchyma, capable of function, has occurred, provided that the time is sufficient and the condition of nutrition is good. In those cases in which the nutrition is low, as in amyloidosis, hypertrophy may fail.

In arteriosclerotic contracted kidney the arterial affection is certainly the primary factor leading on the one hand to changes in the kidney, on the other hand to cardiac hypertrophy. In the genuine contracted kidney, on the other hand, the cause of the cardiac hypertrophy must be found in that noxa which has also led to the affection of the kidney, and which as yet is entirely understood only in a few cases, as in the lead or gouty kidney. The cardiac hypertrophy in other affections of the kidneys is explained by the increase of arterial blood pressure, brought about by the contraction of the smaller arteries, which itself, as in uremia, is due to the toxic irritation of substances secreted by the kidneys, thus by renal insufficiency (Senator).

The therapeutic deductions for the treatment of contracted kidney are especially to combat the increased blood pressure as much as possible, by every means, and at the same time to maintain the working capacity of the heart. If there are signs of a rush of blood to the head, the face being flushed, and the patient complaining of vertigo and headache, the patient must be put to bed, the trunk elevated. Leiter's cooling apparatus applied to the head, catharsis may be induced, and, in very plethoric persons with a high tension pulse, venesection may be done, as warmly recommended by Bartels. For the palpitation, cold applications to the heart and bromids or aqua Lauricerasi internally are indicated. If the cardiac force threatens to give out, digitalis must be given. For the sense of oppression Nothnagel has warmly recommended in his lessons the use of diuretin in very small doses, about 0.1 gm. three times a day, a dose from which a diuretic action cannot be expected. Through insufficiency of the left ventricle, a painful state of cardiac asthma may develop which may best be combated by the use of nitrites.

THE HEART IN INFECTIOUS DISEASES

Diphtheria.—Diphtheria is an infectious disease which involves the heart in a very serious manner. In general, we may attribute to the heart in children a greater resistance than to that in adults, probably because all those noxæ which during life act on the heart have not yet affected the heart in children (abuse of alcohol and to-

bacco). But we must not impose too much on the heart in childhood where its resistance to the toxic products of Loeffler's bacillus is concerned.

In children who have died of diphtheria, we usually find the heart flabby and dilated, a fatty degeneration of the heart muscle, acute interstitial myocarditis, occasionally even fragmentation of the cardiac muscle fibers, and hemorrhages into the muscle of the heart as well as into its serous coverings. The opinion of Ostreich, that these changes cannot be found in the heart of children, is an erroneous one (Baginsky). Of a hundred diphtheria cases, about forty are affected with myocarditis, the percentage increasing with the age, and being higher in the faucial than in the laryngeal forms (Forster). Every myocarditis met with in young children leads to the suspicion of a previous diphtheria. Sometimes a well-developed endocarditis may arise in the course of a diphtheria, and a few organic valvular lesions, too, may be traced back to a diphtheric infection. Recently Wiesel calls attention to changes in the peripheral vessels in the course of diphtheria.

In the clinical picture of diphtheria in children, the high degree of paleness of the skin first strikes us; the pulse is generally soft, somewhat dicrotic, reaching 102 to 150 beats in a minute. Beside tachycardia, irregularity of the pulse is quite frequent, and these symptoms may last for weeks and months after the disappearance of the primary faucial process, especially in those cases where paretic manifestations indicate that the organism is very susceptible to the toxins of the Loeffler bacillus. In other cases bradycardia may develop, and very frequently in convalescence. This is a symptom found quite often in other infectious diseases and therefore designated postinfectious bradycardia.

Galop rhythm occurs not rarely in moderate cardiac weakness in diphtheria; the accentuation may be on the first or on the second sound, but at any rate the supernumerary sound is, according to Baginsky, a systolic one. Cuffer and Barbillion designate it as "meso systolique" and consider it a sign of marked weakness of the heart.

Very much dreaded is the paralysis of the heart which sets in at the height of the disease, especially in septic cases, or after the disappearance of the faucial symptoms, when the children seem to have reached the period of convalescence. From the practical point of view we distinguish an early and a late paralysis of the heart. Of special importance is the fact that cases apparently very light may end with paralysis of the heart. This has often been observed, though not understood. We are occasionally confronted by most extensive paralyses, following a diphtheria not observed by the

patient, or pronounced an "angina with coating" by the family physician.

The cardiac paralysis occurs usually in the following way: The child suddenly becomes prostrated, pale, and may suddenly fall down dead, or else the condition may last for hours. He has the sensation of severe oppression in the chest, and, if it is an older child, a foreboding of death. A peculiar apathetic dreariness overcomes the child, and he does not react to this mortal agony with vehement motions, but lies anxiously in his little bed avoiding all exertion. Vomiting and diarrhea are dangerous symptoms, probably caused by the anemia of the brain and perhaps by the anemia of the intestinal tract. The heart action may be either very fast or very slow, the pulse rate may be below forty. The congestion of the liver is another expression of the suddenly developing cardiac insufficiency; in a few hours the liver may reach a hand's breadth below the costal arch, severe pain resulting from the overextension of its capsule. Thrombosis may sometimes develop in the heart, producing emboli in the brain or in the lungs, and thus the fatal end.

Concerning the prognosis, it must be conceded that the myocardial changes permit a *restitutio ad integrum*, but in many cases there remains a decreased working capacity of the heart. In general, the early appearance of cardiac symptoms is unfavorable; the myocarditis of later development heals more easily.

The patients must be kept in bed as long as they show anomalies of their cardiac activity. The rule also holds for adults, that patients have to be kept in bed after the disappearance of the local affection until the postinfectious bradycardia disappears. In convalescence support of the heart must receive the greatest care. One not seldom sees patients whose hearts have been neglected during convalescence, and who display a diminished capacity for work, and suffer from nervous symptoms which they refer to the heart.

What has been said in regard to the examination of the heart holds true also for the examination of the urine. As long as traces of albumin are still present in the urine of a diphtheric patient one must be prepared for cardiac complications, and in most cases in which patients, after an interval of apparent health, have died suddenly from a fatal paralysis, a careful examination of the urine would have called attention to the danger in which the patient was, and would, perhaps, have enabled us to avert it. If a marked cardiac weakness has become established, if embryocardia or galop rhythm exists, one must try to act on the heart with all our means of stimulation. Digitalis does not act fast enough, and must be reserved only for those cases where apparently no danger is imminent. Preferable is the tinctura strophanti and injections of the sodium

salicylate of caffein, or camphor; in children, tea, coffee, alcohol, hot baths, and eventually mustard baths; finally tinctura Moschi, tinctura Bestucheffii, or ether aceticus. In one case A. Hecht obtained a favorable result from the inhalation of oxygen.

It is a very deplorable fact, not to be denied, however, that the antitoxic serum treatment of diphtheria has produced no essential change in regard to the prevention and cure of the severe symptoms on the part of the heart. The cause for this lies probably in the fact that the noxious effect of the toxins has already taken place, and can no longer be canceled by the neutralization of the toxin still free in the organism. Therefore the diagnosis of diphtheria must be made rapidly, and even in doubtful cases serum must be given; at any rate, it is always desirable to give a large dose of antitoxin to accomplish a rapid and complete toxin neutralization. The procedure advocated by different authors of injecting small doses several times certainly gives less hope of preventing this dangerous condition.

Scarlet Fever.—*Toxic Injury to the Heart.*—The circulatory disturbances in scarlet fever deserve weighty consideration. This disease is a serious danger for the heart, of 191 patients 35 per cent. showing severe cardiac disorders. The affection of the heart is probably not dependent on the severity of the case. Three factors in the course of a scarlet fever may lead to injury of the heart, which threatens life: 1. The grave toxic scarlet fever (scarlatina maligna) usually causes death before the other manifestations of the infection have developed to a full clinical picture. Henoch was the first who considered the heart as the organ in immediate danger, and in accordance with this conception the heart is found at postmortem usually relaxed and pale, more seldom contracted, chiefly in the left ventricle.

In the less severe forms, also, the action of the toxin on the heart is manifest. For the pulse rate is higher than it should be to correspond with the temperature; this may occasionally be found in very slight cases, so that the higher pulse frequency need not always be the cause of great anxiety. Thus Heubner states that a child of five to six years with a temperature of 39.5° C. may have a pulse rate of 150 to 170; with a temperature of 38.1° C., a rate of 124, without any danger to life. Indeed, counts of 200 in the minute have been observed, and, nevertheless, recovery has taken place. On the other hand it may be said that the severest cases do not lead to a farther increase in the pulse count, and, as Heubner reports, in a case with fatal termination having a temperature of 42.1° C., there was a pulse of 196. If, after the initial tachycardia, the pulse frequency decreases and later on again increases it speaks for involvement of the heart. Therefore we must believe that the toxin of scarlatina has an accelerating

action on the pulse like atropin, and produces changes in the peripheral vascular system as Wi sel has proved anatomically. There can be no doubt that the irritability of the vasomotor nerves is changed (Heubner), and one needs only to stroke the exanthematous skin with the finger to be able to write on it: this is referable to the spasm of the vasoconstrictors.

This is just the reverse of the phenomenon which one usually finds in dermographia.

The character of the pulse is soft, usually somewhat celer, but not dicrotic. In the severe septic forms marked irregularity of the heart action and dilatation of the ventricles exists. In this state, fatal collapse may develop. v. Pirquet states that "heart death" in the convalescent period of scarlatina does not occur as in diphtheria. The postinfectious bradycardia is also to be observed in scarlatina, being easily proved during sleep.

Endocarditis and Myocarditis Scarlatinosa.—As complications in scarlet fever, inflammation of the endocardium is not common; this may be a rheumatic endocarditis since rheumatism is very frequent, especially in the wrist-joints, in scarlet fever, or malignant endocarditis may develop from metastasis. A myocarditis is not infrequent, leading through dilatation to cardiac weakness, but only rarely to the sudden collapse which is seen in diphtheric myocarditis. There exists at the same time an extreme irregularity of the pulse.

The diagnosis of endocarditis is not easy. In the benign form the patients show no severe disturbance of their general condition; a systolic blowing may be heard over the heart or a slight accentuation of the second pulmonic sound, and thus it will not be easy to distinguish between a febrile and an organic murmur. Only the farther course, the persistence of phenomena after defervescence, the ever more marked accentuation of the second pulmonic, and the signs of gradually developing hypertrophy leave no doubt that we have to deal with a real disease of the valves leading to a permanent lesion. So a mitral insufficiency is a more frequent sequela of scarlet fever than of diphtheria.

Nephritis Scarlatinosa.—The involvement of the kidneys occurring in scarlatina may exert a dangerous influence on the heart. With the onset of nephritis the pulse increases in frequency with the elevation of temperature, but may also be slow and arrhythmic. Heubner observed in the case of a boy of eleven years in the first week of nephritis a pulse frequency of 96 to 100 beats, in the second week a fall to 66 and 60, and in convalescence again a rise to the first figures. The scarlatinal nephritis usually rapidly leads to a marked dilatation and hypertrophy of the heart. In adults this is not, however, so pronounced, and is also of much rarer occurrence. The apex

beat, soon after the onset of the nephritis, becomes diffuse, the area of dulness is enlarged, the pulse first slow, later on accelerated, the filling and the tension of the arteries decreased. Subjectively, the injury of the heart is felt as a sensation of oppression, and occasionally, especially if the left ventricle gives way, a true cardial asthma may develop.

Riegel sums up his clinical observations on the development of cardiac hypertrophy in scarlet fever in the following paragraphs:

"1. In most, if not in all cases of scarlatinal nephritis, signs of increased arterial tension are to be found at the onset of the disease, nearly synchronously with the appearance of albuminuria.

"2. This heightened tension of the aortic system, if very pronounced, is constantly connected with slowing of the heart action. There often exists at the same time some irregularity of the heart. The higher the arterial pressure the more marked, in general, is the retardation of the pulse.

"3. With the decline of the nephritis the frequency of the pulse increases proportionally to the decrease of the blood pressure.

"4. The enlargement of the heart is a secondary consequence of the increased pressure; it develops only after the high blood pressure has been maintained for some time. Clinically, demonstrable enlargement of the heart is only to be found in cases of very high arterial tension, and may be demonstrated within a few days after the onset of the nephritis."

The treatment must be adapted to the different indications. In the severe toxic forms a trial should be given to Moser's serum. According to Moser's directions, a dose of 30 to 180 c.c. should be injected at one time, but Schick has recently advocated the injection of 200 c.c. at once. The serum gives hope for success only if injected within the first three days, and in severe toxic cases its action seems to be an antitoxic one, though from its mode of preparation one might expect a bactericidal effect. In the first few hours after the injection of the serum the temperature and pulse frequency sink. It is not at all rare for the pulse to decrease 40 beats in a minute; the cyanosis diminishes, the pulse becomes more difficultly compressible, its inequality and arrhythmia disappear, the pendular rhythm of the heart can no longer be heard, and the children give an impression of euphoria. It is certainly advisable to inject the serum only in severe cases, since from the great quantity of serum injected, the phenomena of serum disease develop much more frequently and are much more intense than is the case in injections of diphtheric serum. Yet in severe cases one will gladly risk these disagreeable secondary manifestations. One must try to improve the cardiac weakness through excitants, giving large doses of alcohol and camphor. The maximal

dose of camphor in imminent paralysis of the heart is not to be indicated, since ten Pravaz syringes of camphor in twenty-four hours have been repeatedly given without demonstrable harm. Heubner warns against the use of cold baths, fearing that the blood may be driven from the surface to the internal organs, but if trained nurses are at hand this danger may be avoided by good friction on the body. However, the suggestion of Heubner to substitute the cold baths by wet packs may be followed; for this object he recommends water of 15° C., changing the packs every ten to fifteen minutes until the temperature has fallen. In order to produce deep inspiration, and thereby an improvement of the circulation, warm baths with cold douches on the neck will be found serviceable.

If we have to deal with an endocarditis of the rheumatic type we will give a trial to aspirin, and try to assist its action by diaphoretic measures. For the cardiac disorders in the course of nephritis, Steffen has recommended ergot, in the form of the extract, 3 to 4 gm. in 100 c.c. water; one dessertspoonful of this solution is given three times daily. Strychnin nitrate in doses up to 1 mg. may be injected, also camphor. With the effect of digitalis Heubner was not satisfied. Of greatest importance is, above all, the treatment of the nephritis.

To a certain degree, prophylaxis is possible, though it fails in many cases. It is advisable in scarlet fever to keep the patient in bed for at least four weeks and give him nonirritating food; it will be desirable to dilute the urine through a sufficient supply of liquid, so that the renal tissue is not injured by the passage of toxins in a too concentrated form. Nevertheless, all these measures will in many cases miss their aim. O. Vierordt, in an epidemic with marked tendency to nephritis, has seen no success from the strict milk diet and rest in bed. No more are we able to prevent the occurrence of nephritis through the use of Moser's serum or the administration of urotropin, which has been advocated for this purpose. If the nephritis has once become established, we will institute the therapy appropriate for the severe acute forms of this disease.

As a supplementary remark, it may here be stated that an acute interstitial myocarditis may follow other inflammatory or infectious diseases of the skin, combustions, and general eczema, and may lead relatively late to heart death (Forster).

Measles.—Measles rarely involves the circulatory organs in a severe degree. Myocarditis and pericarditis are scarcely observed, though an endocarditis may sometimes be met with.

Jürgensen remarks that the heart in the course of measles seems to be entirely sufficient in spite of the high fever, the diminution of respiratory surface, due to bronchitis, and pneumonic processes. But here also the genius epidemicus seems to play some part. Breyer

in 1883 observed an epidemic of measles in Würzburg in which endocarditis occurred quite frequently. Yet it is doubtless true that in measles complications on the part of the heart may occasionally be simulated in the following way: through obstruction of the bronchi the lungs are less filled with air and so the heart lies more superficially than normally. This produces enlargement of the cardiac dulness and gives the impression that the sounds over the base, especially over the pulmonary artery, are louder. If, with all this, an anemic murmur is present, the diagnosis "endocarditis" is very seductive, and one may avoid this error only by considering the extension of the lungs in relation to the position of the diaphragm. In any case we will try to support the cardiac force in patients who are normally somewhat delicate, giving strengthening food, as far as the condition of the patient and the state of the intestinal tract will allow, and stimulating him with wine and beef tea.

Against the cardiac disorders in the pneumonia of measles, warm baths with cold douching act excellently, producing deep inspirations and, through aspiration of the blood into the thorax, a better supply of blood to the heart.

Typhoid Fever.—At postmortem examinations of typhoid cases, endocarditis is seldom found, more frequently diseases of the cardiac muscle, cloudy swelling, and fatty degeneration, albeit these affections are not as frequent as in diphtheria. Interstitial myocarditis is found much oftener.

In regard to the clinical symptoms on the part of the circulatory organs in typhoid fever, it is generally known that the pulse often appears retarded as compared with the elevation of temperature—relative bradycardia. Curschmann reports in adults with a temperature of 40° C. a pulse-rate of 80 to 100 per minute. As to the relation of pulse frequency to temperature in childhood Gerhardt pronounces the following condition as the usual one: "Above ten years of age with a temperature between 38° and 40.5° C., the pulse-curve remains below that of the temperature so that about 40° C. corresponds with a pulse of 120; 38.5° C. with one of 90 to 100. When the temperature becomes normal a temperature of 37° C. shows 80 to 90 beats (type in adults). In children under six years both curves meet at the high temperatures so that 40° C. to 38.5° C. corresponds to 140 to 120 beats. When the temperature becomes normal the greater frequency of the infantile pulse becomes evident, the pulse curve reaching above the temperature, 37.5° C. corresponding with about 120, 37° C. with about 110 beats. The intermediate ages show a corresponding relation. Irregularities of the pulse-rate are more frequent than of the temperature, but are usually transient. Bradycardia is very rarely found in very young children. In convalescence one sometimes ob-

serves irregularity and high rate of the pulse with entirely normal temperature.

At the end of the second week, adults as well as children show the pulse well filled, but soft and dicrotic, and in grave cases the dicrotism may appear still earlier. Even polycrotism may occasionally be found on the sphygmographic tracing. Further, the pulse in typhoid shows great differences in its count morning and evening, as well as a great lability on the least exertion or emotion.

High pulse counts from the beginning disturb the prognosis. In the amphibolic period of fever the pulse again becomes smaller and harder and the dicrotism disappears. In convalescence the count varies between 80 and 100, and in certain instances together with a subnormal temperature one finds bradycardia very marked, below 40 beats per minute.

A sudden rise of pulse frequency in typhoid fever always points to complications. This may be an intestinal hemorrhage or perforation or, if the rise is not so fast, another complication, as pneumonia. In general, a rise of the pulse should always be observed with uneasiness and demands investigation of the cause. A transient irregularity of the pulse, according to Curschmann, is not of very great importance, whereas inequality is an unfavorable sign. But if the pulse is continually small, accelerated and irregular, the prognosis is very unfavorable (Nothnagel).

According to Griesinger and Hayem, a continued, very frequent, irregular and unequal pulse speaks for myocarditis typhosa; the pulse becomes much softer, easily compressible, and the dicrotism disappears. The apex beat is weak, the second aortic sound is very soft, the second pulmonic markedly accentuated. Dilatation can usually be proved. However, the myocarditis in typhoid fever is far less dangerous than in diphtheria.

Very much dreaded is the collapse, which, in severe cases, may occur even in convalescence. Every emotion, every physical exertion, any straining on defecation may produce such a collapse, and it is clear that a collapse is more threatening in its significance the earlier it occurs. In very severe cases it may appear as early as the second week. Where there is a tendency to it, sitting up must be forbidden. Nothnagel used to relate in his lessons that he himself once suffered a severe collapse during convalescence from typhoid fever from sitting up in bed, and all but lost his life. How many of these manifestations of cardiac weakness are due to the injury of the heart itself and how many to injury of the vessels is as yet not entirely clear. Certainly, the peripheral circulation suffers severely, as can be seen by the tendency to venous thrombosis. Not rarely aortitis typhosa is associated with endocarditis, giving no clinical symptoms.

In the treatment of the cardiac weakness all those measures will be considered which we use generally in this condition: alcohol, caffein, ether, camphor and musk, and, before all, the bath treatment. The last will be dealt with more in detail at another place; here we wish only to mention that the half-baths are an excellent means of combating the collapse in severe typhoids. But the friction must be very vigorous, if possible performed by three nurses; and before the bath, alcohol, best in Stoke's mixture, should be given. The abdomen, of course, is not to be rubbed. If collapse takes place during the bath it would be entirely wrong to take the patient out of the bath, on the contrary, he must be rubbed the more vigorously. Through repeated cold douches on the neck the respiratory and circulatory centers are reflexly stimulated. If it seems risky to place the patient in a bath-tub, the treatment will be restricted to partial bathing, the application of Leiter's cooling apparatus on the heart, and cold packs. But just this last procedure may lead to collapse if the patient sweats strongly.

Sepsis.—Of great importance is the observation of the heart force in all septic diseases, because the severest forms of endocarditis may develop in sepsis. Since occasionally every murmur over the heart is absent, the diagnosis of this affection will sometimes be impossible. Whether the heart is directly affected or not, the pulse rises from the increased body heat, and in severe cases its frequency will be above the corresponding temperature. It is easily compressible and in most cases arrhythmic and of low wave length. If pyemic metastases occur, each formation of a new focus produces a marked increase in the pulse frequency, which disappears when the pus has been drained through operation. A slight dilatation and systolic blowing are found over the heart, symptoms which do not justify us in concluding the presence of endocarditis, however prepared we must be for this complication. In puerperal sepsis the pulse is usually higher than would correspond to the body heat, and already in the second week pulse counts of 120 to 140 may be found (Lenhartz).

Malaria.—In malaria, the heart is rarely affected. Systolic murmurs may be present, generally due to anemia; at most a small degree of hypertrophy and dilatation as a result of affections of the myocardium or endocardium are to be observed.

Cholera Asiatica.—In Asiatic cholera, the heart usually suffers severely; thus one speaks of an asphyctic stage, a pulseless stage, because the heart force is so sunken that one is unable to feel the pulse in the radial artery. The causes of the cardiac weakness may be various. In the first place, the heart is only insufficiently supplied with blood, since its quantity is diminished through concentration.

Then we know from examination of the pulse in severe abdominal affections, as, for instance, in incarceration of the intestine, that the power of the heart is reflexly considerably reduced. Finally the toxins of the cholera vibrio are severe cardiac poisons. The proof of the impaired circulation is the coolness and cyanosis of the peripheral parts (*stadium algidum*).

To combat the exsiccation, beside the usual analeptics, physiological salt solution may be used, and at the same time one will try to bring about dilatation of the peripheral vessels through warm packs or by the application of cold as Winternitz has recommended.

Cholera Infantum.—Very similar to Asiatic cholera is the picture of the severe gastroenteritis of infants, especially the form which occurs so frequently during the hot summer months as summer diarrhea. In this affection the pulse is scarcely palpable, the peripheral parts feel cold, and the exsiccation may be recognized by the persistency with which the skin remains in folds after being pinched, by the retraction of the fontanel, by the shoving up of the occipital bone under the parietal bones, and by the nervous manifestations of hydrocephaloid.

In the treatment, infusions of physiological salt solution should be considered first; they relieve the exsiccation for some time at least, and through improvement of the cardiac force produce a reanimation of the child. Injections of camphor, tokay wine, mustard baths, etc., may also be used to stimulate the heart.

Influenza.—Influenza likewise seems to have a peculiar tendency to affect the heart. Beside the harmful influence of the high temperature and the involvement of the lungs, the toxins of the influenza germs seem to have a specific injurious action on the heart. Drasche has observed that the pulse frequency in influenza is higher than would be expected from the temperature. But bradycardia is occasionally present, relative as well as absolute; this is the neurotoxic form of influenza with involvement of the vagus nerve, whereby the pulse count may fall below fifty. Bouchard states that the pulse frequency is very labile, that it increases on sitting up, and that arrhythmia is also often found. A tendency to collapse exists in severe cases, which in heart and valvular diseases renders the appearance of influenza a serious complication. In addition, endocarditis and pericarditis may be found after influenza.

CONSTITUTIONAL DISEASES

Diabetes.—In diabetes we sometimes find disorders on the part of the heart, since diabetes of old people is often connected with arteriosclerosis, and, if this affection is extensive, cardiac asthma

and angina pectoris may be found. In the diabetes of the young, which, as is known, takes a much severer course, disorders of the heart do not play any part, according to Frerichs. Yet it is in these cases that one finds now and then a real atrophy of the heart.

Obesity.—Obesity affects the cardiac force first by introducing new resistances into the circulation, thus putting greater demands on the heart. At the same time the cardiac strength is injured because a fat infiltration of the heart takes place, and finally, as v. Noorden emphasizes, it must not be forgotten that the respiration in the obese suffers, too, and in this way an important aid to the cardiac force is lost. The cardiac sounds are soft and pure; occasionally the second sound, especially after physical exertion, may be accentuated at the apex and over the aorta. An enlargement to the right is not always easily demonstrated, and, according to v. Noorden's conception, is not to be related to a dilatation of the heart since the accumulation of fat in the mediastinum and round the heart also may shorten the sound. The pulse, even on physical exertion, is full, strong, and regular. If a marked degree of obesity exists for a long period, and especially if associated with anemia, symptoms of cardiac insufficiency arise whereby each exertion leads to oppression, fatigue, and palpitation. In an advanced stage, even if the patient is quiet, he is rarely free from discomfort, the pulse is small, the peripheral parts are cool, and the tendency to syncope and vertigo show how poor is the blood supply to the brain. On physical examination, one finds enlargement of the cardiac dulness, probably due not alone to the fatty covering of the heart, but also to dilatation of the cardiac cavities. The apex beat often is not palpable, the sounds are pure but soft, and a systolic blowing may be present. The pulse may be slow, below 60, irregular, sometimes bigeminal, and increasing rapidly in frequency on any physical exertion. In this stage we are no longer impressed by the clumsy helplessness of the obese, for a serious and severe state of disease has developed. Fatigue, as produced by forced antifat treatment and by training, may lead to sudden death.

Another deleterious factor usually associated with those just mentioned is the abuse of alcohol, which is one of the causes of obesity and of arteriosclerosis. Then a myocarditis may supervene upon the minor affections of the heart, leading to bradycardia, and in the further course to severe dyspnea and general dropsy. These patients frequently die of intercurrent diseases, possessing absolutely no resistance against acute infections, whereas patients with organic valvular lesions stand these infections very well. The same behavior toward acute infectious diseases is seen in overfed children. With justification one sounds the warning against overfeeding, which even in infancy decreases the natural immunity remarkably.

In regard to the therapy, the first principle will be to combat the obesity, following the revolutionary methods of Oertel. In a person with heart disease the development of too abundant fat ought to be combated by the house physician; a careful systematic antifat treatment, with constant attention to the cardiac strength, will be the most important therapeutical indication for the cardiac troubles of obese persons. Groedel recommends, on the appearance of severe disorders, to strengthen the heart through prolonged digitalis treatment, and then to introduce the antifat treatment, energetically at first, and after the first results, slowly.

Diseases of the Blood.—Hemorrhages, superficial or internal, produce a falling of the blood pressure, rendering the pulse small and easily compressible, at the same time the artery feels contracted. This latter is a tendency to compensation on the part of the organism, which tries to narrow the stream bed when the quantity of blood is diminished. In fact, the experiment on the dog teaches that after a loss of a quarter of the total quantity of blood, the blood pressure sinks for only a short time, and soon reaches the former height.

If anemia exists for a longer period, because the hematopoietic organs are not capable of regeneration or on account of continued small losses of blood, then severe manifestations of the circulatory system appear, fatty degeneration of the heart develops, the cardiac action becomes feebler, the cardiac sounds become softer, and accidental murmurs are to be heard. The pulse remains soft, but in time may again reach the former fulness and normal height of its wave. A remarkable lability of the cardiac action against any physical exertion exists, the pulse frequency mounting at once.

The degeneration of the heart muscle in severe chronic anemia explains the sudden heart death in the course of such diseases.

In progressive pernicious anemia subjective discomfort on the part of the heart is usually present, the patients complaining of palpitation and sensations of oppression. This discomfort appears sometimes in attacks, at other times it is continuous. Examination of the heart shows the apex beat heaving, a diffuse indulation over the whole anterior wall of the thorax, and systolic, more rarely diastolic murmurs over the apex and over the base (Biermer). The tension of the pulse is more or less decreased, its frequency is between 90 and 100, reaching 120 on the least physical exertion, as above mentioned.

Similar are the conditions in chronic leukemia, in the lymphatic as well as in the myeloid forms; the degeneration of the cardiac muscle usually present in these morbid processes usually gives no clinical symptoms. In acute lymphatic leukemia, on the other hand, we find almost always a very fast small pulse.

Chlorosis.—The knowledge of the existing relations between chloro-

sis and affections of the vascular system reaches back to Rokitansky and Virchow. Rokitansky found a severe form of chlorosis in hypoplasia of the vascular system, and especially in hypoplasia of the female generative organs. Virchow described, as a striking finding in chlorosis, narrow arteries with thin walls, but it is clear that this anatomical finding is not the basis of all cases of chlorosis. For this change is a constant and unalterable one, while the chlorosis, in many cases, can be readily influenced therapeutically. v. Noorden emphasizes, therefore, that this change in the vascular system may produce a picture which clinically is entirely similar to chlorosis, but it must not be forgotten that the ailments of the chlorotic individual appear usually at puberty, while the above-described habitus is a congenital condition.

Most chlorotic girls complain of palpitation, but there exists no parallelism between this complaint and the objective findings of the chlorosis. One finds patients with very severe chlorosis who have palpitation only on physical exertion, as ascending stairs, and yet feel entirely well if quiet. A certain lability of the pulse exists at the same time; it rises rapidly and falls again to the normal rather abruptly; in other cases the acceleration of the pulse lasts much longer than the bodily exertion which has produced it. Arrhythmia is seldom found. The pulse is usually quite full, somewhat celer, and sometimes dicrotic. This accelerated cardiac action has, according to Noorden, to be considered as a compensatory process on the part of the organism in order to procure the necessary quantity of oxygen, since the oxygen carrier, the hemoglobin, is contained in the blood in insufficient quantity.

Nervous cardiac disorders appear as attacks during which the cardiac activity may be entirely normal, and we have only to deal with a pathological sensation of normal conditions; in other cases, however, these attacks are associated with increased heart action, but in these cases the anxiety, the mental process, may be the primary factor, the disturbance of the heart being secondary.

Continual tachycardia may sometimes be observed in chlorosis if the disease has developed so rapidly that the organism has not had time to become adapted to the diminished stock of hemoglobin. In these cases pulse counts of 110 or more are found during rest, the pulse volume being relatively very large. The usual pulse count in chlorosis, according to the investigations of v. Noorden, vacillates between 80 and 100. The examination of the heart rarely shows any considerable enlargement of cardiac dulness. If blowing murmurs are present we have to decide whether we have to deal with anemic murmurs, which, transmitted from the large veins, appear at the base of the heart, or with a relative insufficiency due to the dilatation. The

enlargement of the cardiac dulness to the right is often caused by the superficial position of the heart produced through retraction of the lungs, to which the superficial, accelerated respiration of the chlorotic may be blamed. Through respiratory gymnastics one may succeed in bringing about a better filling of the lungs, thereby producing a smaller cardiac dulness. On the other hand, Grumnach has proved by X-ray pictures that, owing to the higher position of the diaphragm, the heart usually assumes a more nearly horizontal position, simulating an enlargement. The diastolic murmurs which are to be heard in chlorosis, are referred by Sahli to the cervical veins; he regards them as a transmitted venous hum (Nonnensausen). v. Noorden succeeded, by compression of the right jugular vein, in causing the murmurs over the heart to disappear. However, diastolic anemic murmurs are very rare (Leube).

The subjective sensations of heat and cold so often complained of by chlorotics point to an injured vascular tonus. The tension of the pulse is usually decreased in character, being quite similar to the dicrotic pulse of fever. As in aortic insufficiency, capillary pulsation may be found on the skin of the forehead which has been made hyperemic by friction (Rethers and v. Noorden). If the pulse is transmitted through the dilated capillary system into the veins, venous pulsation may be observed ophthalmoscopically on the retina.

In entirely healthy persons, venous murmurs may be produced by giving the head an appropriate position, as by turning it sideways. Yet in chlorosis one finds the venous hum in entirely normal positions of the head, and an avoidance of any pressure with the stethoscope. This proves it is not necessary to produce an artificial stenosis, and that the normal lumen of the veins is sufficient to produce vortices in the blood, which in chlorosis streams with increased velocity. In this latter condition a compensatory process has to be seen; on the other hand, circulatory disorders arise which are associated with a considerable retardation of the blood-stream; this may lead to venous thrombosis (sinus thrombosis), a very fatal disease characterized by cerebral symptoms and local edema of the face.

CENTRAL NERVOUS SYSTEM

Since the centers for the cardiac movements and the action of the peripheral vessels are localized in different parts of the brain, we will find very manifold disturbances in the circulation in diseases of the brain. The vital center in the medulla oblongata undergoes extensive changes in morbid processes within the cranial cavity, and from different parts of the nervous system reflex actions may be produced on this center. These facts have been demonstrated experimentally.

François Frank and Pitres succeeded in producing tachycardia through stimulation of the cortex of the brain; Druif, through irritation of the dura with needles, in increasing the frequency of the pulse and the blood pressure. The influence of the brain cortex on the peripheral vascular system is proved not only by animal experiment, but by the everyday experience that goose flesh is produced through fear and that shame leads to erythema. A much more powerful action than that of the cortex of the brain on the circulation is possessed by the subcortical centers, not perceptible to us. Druif brought the heart to a sudden standstill by section of the cerebral peduncles. The enormous influence which the centers in the medulla oblongata exert on the blood pressure should again be emphasized.

In organic diseases of the brain the cardiac action may be accelerated, retarded or irregular; the acceleration may be due to fever or to disorders in the centers in the medulla, as paralysis of the cardio-inhibitory nuclei of the vagus. At the same time, arrhythmia usually develops on light degrees of increased pressure in the brain and on irritation of certain cortical regions. Bradycardia is a much less complex symptom. It is produced constantly by irritation of the vagus, whether direct or indirect. Monakow once saw at postmortem examination, after bradycardia had existed *intra vitam*, that groups of cells of the vagus nerve were degenerated laterally and dorsally from the nucleus of the hypoglossus. These cell groups had until this time been considered nuclei of phonation. Especially in inflammatory processes of the medulla oblongata and pons, bradycardia may be found. We have, however, not to consider bradycardia as a localized symptom only, for each increase of pressure, whether due to hydrocephalus or to hematoma of the dura or hemorrhage in a ventricle, or to brain tumor, may lead indirectly through irritation of the vagus to bradycardia, whereby the pulse frequency may sink as low as 40 beats a minute. In those cases in which, at the same time, there exists an acceleration from fever, a disproportion between the pulse count and the height of the temperature is present—relative bradycardia—as is found, for instance, in the first stage of tubercular meningitis. If the increased cranial pressure exists for a long period, bradycardia may be absent, the central nervous system having itself become adapted to the increase of pressure.

Slow pulse, later followed by tachycardia with arrhythmia, must always be considered as an unfavorable sign, suggesting as it does that through exhaustion of the nerves the state of irritation has passed into the state of paralysis. Monakow, however, states that a slow pulse may be found also in functional disorders of the nervous system, but here the pulse must be regular and not below 48 beats in the minute. If arrhythmia and a bradycardia below 48 beats exist

together, then, according to Monakow, the deeper parts of the brain are involved.

Apoplexy.—During an apoplectic attack the pulse is usually full, hard and, because of the rising intracranial pressure, slow, usually below 60. This behavior of the pulse is of importance in the differential diagnosis, allowing us to exclude other forms of sudden loss of consciousness, as cerebral anemia (syncope), and internal hemorrhage, as the rupture of an aneurysm, for in these affections the pulse is usually of low tension and accelerated. If the apoplectic attack lasts for some time, the frequency of the pulse may again rise, which is also the case during the stage of reaction. If the disease pursues a fatal course the pulse becomes toward the end small, frequent, and very irregular, and the heart stops before respiration ceases. In a case of hemorrhage in the optic thalamus of the right side Dannhardt observed a very clear pulse of 100 to 120 beats in the right radial artery, while in the left it could not be palpated.

Encephalomalacia.—In cases of encephalomalacia, in which the heart action is usually weak, the pulse in most cases is found full and of high tension; less frequently small, but of high tension.

Brain Tumors.—In brain tumor the increased intracranial pressure announces itself through irritation and subsequent paralysis of the nucleus of the vagus. Oppenheim once found in brain tumor the nucleus of the vagus degenerated. If a brain tumor ends fatally, death usually occurs from loss of respiration; that is, respiration ceases before the heart action. Thus, in a case described by Jackson and Russel, the cardiac action lasted so much longer that through artificial respiration one could preserve the action of the heart for a long time. Cardiac disorders may also be found as focal symptoms, as in a case of Pitres and in another of Oppenheim, in which a tumor of the motor region produced cortical epilepsy and, *quasi* as an equivalent, attacks of tachycardia.

Encephalitis.—The pulse in encephalitis is generally accelerated. In acute hemorrhagic encephalitis, first a period of relative bradycardia may be observed, followed by tachycardia, while in other cases the pulse is during the whole disease and until late in convalescence accelerated.

Brain Abscess.—In brain abscess there is often a very considerable slowing of the heart action, pulse counts of 50, even 30, and in one case reported by Toynbee and Wieden of 16 to 10 beats in the minute, are mentioned in the literature. Bradycardia and headache may for a long time be the only symptoms of brain abscess. With the promptness of an experiment Gussenbauer saw a pulse frequency which had sunk to 46 rise again to 104 as soon as he removed the pus from the abscess. Yet the inverse action has also been observed, the pulse

having been pathologically increased before the drainage of the abscess and having sunk immediately afterward. It is clear that the action of the pulse in brain abscess can be a very variable one, for three factors have to be considered, which, in different ways, influence the frequency of the pulse. First, the increased cranial pressure, which, through irritation of the vagus, has a slowing effect on the heart; second, the toxins which pass from the suppurative focus into the circulation; and, finally, the increased body heat, both of which latter facts have an accelerating action.

Martius has called attention to the interesting influence on the pulse of change of position of the body. The differences are so great that the count in one patient was 44 on lying down, 80 on sitting up. The rhythm of the cardiac action is usually only disturbed in the final stage of the disease, when tachycardia has developed. In the cerebral manifestations of adults, tachycardia speaks in general for meningitis, bradycardia for brain abscess. If bradycardia appears in the course of a purulent otitis media, the danger of brain abscess must always be thought of; yet brain abscess or purulent meningitis or both together may develop from an otitis media without the occurrence of bradycardia.

Concussion of the Brain.—Not only brain pressure of whatever origin, but also concussion of the brain leads to bradycardia, and indeed sometimes of a very high degree. Immediately after trauma one ought to observe not only the loss of consciousness and vomiting, but the equality of the pulse, whose retardation indicates a concussion of the brain. If the patient has rallied, and, after some time, threatening symptoms appear anew, as may be the case in a growing hematoma, from lesion of the middle meningeal artery, then the pulse becomes slow again.

Meningitis.—The statement that the pulse is slow at the onset of meningitis, and later on becomes accelerated, is not always entirely correct. At least in most cases of purulent meningitis a slow pulse is absent. Schultz, too, has failed to find bradycardia at the onset of this disease, though he finds a great lability of the pulse frequency in the first stage, in the sense that slower and faster heart beats often immediately follow each other. Ziemssen has expressed the opinion that slow pulse is usually found in tubercular meningitis, but not in the purulent form. And indeed, in the tubercular form, one may find a fall of the pulse count to 60, together with arrhythmia. In advanced cases, however, the pulse becomes fast, constantly increasing in frequency until, at the end, the heart beats exceedingly fast, and pulse counts of 200 and over are not uncommon. Not only is the temperature elevation a factor in the tachycardia, but, above all, paralysis of the vagus.

The view of Schultze that irregularity of the pulse is not very frequent in hearts previously normal, at least for children, cannot be accepted. Certainly a complete arrhythmia, "delirium cordis," is not very frequent.

Progressive Paralysis.—In progressive paralysis Mendel found a normal pulse action, though Krafft-Ebing points out that in the farther course of the disease usually a pulsus tardus and monocrotism develop. There exists a tendency to fluctuating hyperemia, as is seen in Trousseau's spots, which are commonly observed in this disease, and in the fluctuating congestion of the brain. The paresis of the vessels accounts probably for the deficient heat regulation, which develops toward the end, the patient showing subnormal temperature, which may be explained by the failure on the part of the vascular system to defend itself against loss of heat.

Diseases of the Spinal Cord.—In tabes dorsalis many patients complain of the sensation of congestion, a manifestation of disturbed vascular tonus; tachycardia is frequent. Disturbances of the cardiac action must certainly be expected in bulbar paralysis since the centers for the heart and vascular system lie in the medulla oblongata. In progressive bulbar paralysis severe disturbances of circulation and respiration are observed, in fact due to severe injury of the vagus. Dyspnœa and an irregular frequent respiration with a pulse count of 130 to 150 are present. Also in acute bulbar paralysis similar disturbances on the part of these organs are common. They have, however, in the bulbar symptom-complex, not to be considered as a manifestation of severe general changes in the central nervous system, as for instance brain tumor, but rather as focal symptoms, which nevertheless may become fatal. Death does not result from the injury to the circulation, but from the primary cessation of respiration.

Also in cervical myelitis, tachycardia has to be expected since the nerve tracts descend from the medulla in the spinal cord. High focal localization in multiple sclerosis explains the attacks of palpitation and dyspnea.

Affections of the Peripheral Vagus.—If the vagus is diseased in its peripheral course, disturbances arise analogous to those which we are used to see on injury of its nucleus in intracranial affections. Stimulation of the vagus produces bradycardia, paralysis of the nerve tachycardia. The etiological factors are, first, intoxications with lead, alcohol, and phosphorus. The phosphorus intoxication in particular may lead to hemorrhages into the sheath of the vagus, and in this way to irregular and very frequent pulse. Postinfectious neuritis of the vagus is also met with. Edinger observed it following diphtheria, the pulse frequency vacillating between 90 to 100, reach-

ing, during attacks, 140; at the same time emphysema of the lungs developed, another manifestation of the injured function of the nerve. In other cases the neuritis followed a typhoid, and, through irritation of the vagus, pronounced bradycardia and arrhythmia developed.

The function of the nerve also may be injured through mechanical compression. Czermak could compress his vagus by pressure on the carotid and thereby diminish his pulse frequency. This compression of the vagus has been used therapeutically in cases of tachycardia, but the effect is usually doubtful. Compression of the vagus through tubercular glands or mediastinal tumors sometimes brings about tachycardia, with a pulse frequency of over 200. The synchronous attack of emphysema is considered by Tuczek as caused by a spasm of the bronchial muscle.

The treatment of all these conditions is the same. Through the galvanic stream, the anode applied to the heart, or through a Leiter cooling apparatus placed on the heart and the neck, one will try to decrease the pathological frequency of the pulse. For bradycardia no treatment is necessary, unless we are able to remove the primary disease.

HYPERTHYROIDISM

Goiter.—It is known that subjects of goiter, too, suffer from cardiac disorders, subjective discomfort, as palpitation, and from objectively demonstrable changes in the heart-action and frequency, which are irregular and increased. Commonly this has been explained by compression of the pneumogastric nerve, but recently it has seemed plausible that we have to deal with a case of autointoxication, of hyperthyroidism, since the use of thyroidin produces similar disturbances. If a too great quantity of thyroid substance is taken internally, palpitation and an intermittent pulse of variable frequency may be observed. The heart action has, therefore, to be fully controlled if thyroid extract is given, and if a cardiac lesion, especially a myocarditis, exists, the use of thyroid substance is contraindicated.

In strumitis, acute inflammatory swelling of the struma, the pulse is usually very small and frequent; this may be due to the mechanical compression of the nerve or to collateral inflammatory edema.

Basedow's Disease.—Acceleration and accentuation of the heart, together with the subjective sensation of palpitation, is a cardinal symptom of Graves' disease. Palpitation may even be the first symptom of the disease, and will be suspicious for a developing Graves' disease if it appears also during complete rest, since, in all other diseases, palpitation generally follows physical exertion. The sub-

jective sensation of palpitation is a cause of great disquietude to the patient, sometimes of anxiety and sleeplessness. The tachycardia is of moderate degree, for example 90 to 100 beats per minute appearing in attacks, but, in exceedingly severe cases, excessive counts of 200 or more may be seen. The danger in morbus Basedowii lies always in the heart irregularity; dilatation and anemic murmurs over the heart are signs of a severe case. In the vessels, a loud pulsation may be heard, and it is very disagreeably perceived by the patient, especially the throbbing in the carotid and the abdominal aorta.

The treatment of the tachycardia is identical with the treatment of the primary disease, since the heart is the salient feature of all the symptomatology. Daily galvanization of the sympathetic nerve, of the spinal cord and medulla oblongata, and transversely through both mastoid processes, have been recommended in the form of very weak currents (Chvostek). Most authors are quite satisfied with the galvanic treatment, and some state that the pulse frequency sinks very soon after its use. Möbius does not place very great weight on this observation. The mechanical treatment also aims to lower the pulse frequency, and Winternitz states that through the use of Zander's vibration massage of the ribs the pulse frequency may be lowered 20 to 30 beats. But also this result is not very weighty according to Möbius, for he has seen a temporary lowering of the pulse frequency from very different causes. It certainly cannot be disproved that this result may be due to suggestion, which certainly plays an important part in a neuritic disease like Basedow's. Digitalis will only be used if dilatation and the dreaded asystole have once appeared. By American physicians tincture of strophanthus has been very warmly recommended; by others, iodin, ergotin, etc. Still the most effective measures seem to be the bromids and a general dietetic régime. In recent times Ballet and Enriquez injected the serum of dogs on which thyroidectomy had been performed into patients in order to neutralize the toxin of the morbus Basedow through the toxin of these animals. The results do not seem very encouraging; not more than the feeding of milk from goats whose thyroids have been extirpated (Otto Lanz).

Eulenburg gives 10 to 30 drops of the antithyroidin (Möbius) three times a day until 50 c.c. have been given, and after a pause of one week repeats the treatment. Satisfactory improvements are sometimes obtained. Also the X-ray radiation of the thyroid, and unilateral strumectomy may be tried (Karl Beck).

Finally Hallion uses whole horse blood, taken a month after thyroidectomy, giving daily one to two spoonfuls. Under this treatment the tachycardia improves remarkably.

Cardiac Neuroses with Small Goiter (*after A. Pick*).—A peculiar disease which cannot be classed in the group of the goiter heart, nor among the cardiac neuroses, or the formes frustes of Basedow's disease, has been observed by A. Pick in a number of young men between eighteen and thirty years. They all showed increased excitability of the cutaneous vessels (dermographismus), a lesser degree of struma, a light hypertrophy of the heart, principally of the left ventricle, increased reflexes, anisokoria, and increased irritability of the heart on any physical exertion, which announces itself in the rapidly increasing acceleration of the cardiac action.

FUNCTIONAL DISORDERS

The neurasthenia cordis sive vasomotoria, the cardiac weakness of nervous origin, may be produced through different noxæ, sometimes from the stomach, sometimes form the sexual organs. Fürbringer states that even healthy individuals sometimes complain of arrhythmic heart action and palpitation after sexual excesses. These symptoms are accentuated in neurasthenic individuals. A certain hyperesthesia exists which also renders the normal heart action perceptible, and if this perception ceases suddenly the patients believe that their heart has suddenly stopped. In other cases there exists an objective tachycardia, with pain in the region of the heart, radiating into the arms, the pseudo angina pectoris vasomotoria.

The climacteric troubles belong here, consisting in palpitation, attacks of syncope, and feelings of weakness. Objectively one finds either bradycardia or tachycardia, or sometimes embryocardia (hyposthénie cardiovasculaire climacterique).

The treatment has already been discussed at another place. Here we shall only mention the use of the monobromated camphor, given in doses of 0.6 to 0.8 gm. in the evenings as a suppository, and appropriate to remove the nervous cardiac disorders which often disturb the night rest. An electric douche to the heart applied every evening (Franklinization) decreases the pulse frequency and improves the blood pressure.

Chorea.—Chorea, which perhaps would better be taken up under infectious diseases, may lead directly to endocarditis without simultaneous affection of the articulations. A heart lesion will be found much more frequently after relapses than during the first attack of the disease (Gowers).

Migraine.—Formerly two types of migraine were distinguished. In one, which Dubois-Reymond had observed on himself, the face was pale, and the temporal arteries palpable, like a hard cord; this is the sympathetic tonic hemicrania. The contrary behavior is

to be observed in the angioparalytic form described by Mollendorf. The question whether we have to deal with a primary or with a secondary affection is not finally decided. During an attack the pulse usually is small, sometimes slow (Mollendorf observed one case of 48 beats).

Sea-sickness.—The pulse in sea-sickness is sometimes fast, in other cases slow and arrhythmic. Some patients complain of heart palpitations. The circulatory organs do not seem very seriously affected, for it is a well-known fact that patients with a severe cardiac lesion endure sea-sickness excellently.

Hysteria.—The circulatory manifestations in hysteria are very manifold. We shall here refrain from considering the changes in the vessels, the vascular spasms which may lead even to gangrene, and consider only the disturbances of the cardiac activity. One finds not rarely in hysterical individuals abnormally high pulse counts of 140 to 150, which may be continuous, or develop only on physical examination, and arrhythmia and allorrhythmia. Yet bradycardia is observed in other cases, as in that of v. Noorden, where it was permanent, in those of Binswanger in cataleptic conditions, and in those of Brignet and Löwenfeld in attacks of morbid sleeplessness. Such attacks, associated with a very small pulse are probably the cause of the apparent death of the hysterical.

An hysterical pseudoangina pectoris has been described by Huchard which is especially likely to occur when an hysterical patient has the opportunity of observing the picture of the true striking angina pectoris.

The treatment will naturally be a purely suggestive one

INTOXICATIONS

Very many intoxications, acute as well as chronic, lead to disorders of the cardiac activity. Of the chronic intoxications, tobacco, alcohol, and coffee should be first mentioned. An acute intoxication affecting the heart is that with atropin, leading to a very high pulse and respiratory frequency. The pulse-accelerating action of atropin is used not only therapeutically, but also diagnostically; from the effect or noneffect of atropin on the pulse frequency one may conclude as to the localization of a bradycardia. On irritation of the vagus center and the vagus trunk, a neutralization of this bradycardia is possible by paralysis of the motor ends of the vagus in the heart, whereas the true cardiomuscular bradycardia is not influenced by atropin (Dehio).

CHAPTER III

DISTURBANCES OF RESPIRATION, DYSPNEA, AND ASPHYXIA

I. GENERAL PART

General Review.—In regard to the frequency of the respiration, we distinguish acceleration and retardation; dyspnea and asphyixa are other pathological deviations.

Objective and Subjective Dyspnea; Asphyxia.—By dyspnea we understand a forced, difficult respiration, whose frequency may be increased or decreased. It is generally due to an abnormally low content of oxygen in the blood, and an abnormally high content of carbon dioxid; this leads to irritation of the center for respiration and an effort is made at compensation by deepened and accelerated breathing which places increased demands on the respiratory muscles. From this objective dyspnea the subjective form, the sensation of air hunger, is well to be distinguished.

This subjective feeling of dyspnea, together with precordial anxiety, appears generally only when the compensation attempted by the respiratory center has not been entirely successful. Cyanosis then results, whereas a severe dyspnea which is entirely compensated may not produce any subjective feelings of shortness of breath, nor marked cyanosis of the peripheral parts.

If an uncompensated dyspnea has reached a very high degree, the air hunger diminishes because the sensorium is benumbed through the carbon dioxid contained in the blood (carbon dioxid narcosis). This often spares the patient the most terrible agony.

There exists another form of subjective dyspnea which is independent of the oxygen of the blood. It occurs in nervous persons, but also in the normal nervous system as an effect of a depressing mental impression. Though the supply of oxygen is normal, the oppressive sensation of air hunger appears, leading to a very deep respiratory movement—sighing.

If the respiratory center is exhausted by overstimulation, the number and depth of the respiratory movements again decrease, the exhausted muscles partially cease their work, a slow gasping respiration develops, asphyxia. If this is very pronounced it leads to complete cessation of respiration, that form of death in which the respiration stops before the heart action. After complete standstill of the respiration, the heart gradually ceases to act, the right auricle representing the ultimum moriens Halleri.

Forms of Dyspnea.—Pain on deep respiration may cause this to become fast and superficial, as is found in some painful pulmonary diseases, as irritation of the pleura, in rheumatism of the respiratory muscles, in fracture of the ribs, and in trichinosis and peritonitis.

In other cases the respiration is slow, but at the same time abnormally deep and we have to distinguish whether the breathing is retarded on inspiration or on expiration. To the first group belong all stenoses of the afferent air passages, and to the latter certain forms of bronchitis, asthma, and emphysema.

Abnormally deep respiration is occasionally found confined to one side; this is a vicarious respiration, a hindrance existing in the opposite lung whose expansion is somewhat dragging. The term "dyspnea" is not used for this asymmetric breathing.

Increased Frequency.—To estimate rightly the frequency of respiration we need a measure, the more since in fever the respiratory frequency is increased. It is true for adults that in fever, except in respiratory diseases, the relation of pulse to respiration is 4.5:1. The febrile acceleration is associated with only a moderate increase in the consumption of oxygen, amounting to about 20 per cent. (Fr. Kraus). If this relation is disturbed we speak of polypnea, and if the respiration at the same time is difficult, of dyspnea. In general, polypnea is found in nervous diseases, frequently in hysteria, where this accelerated respiration may quasi epidemically develop in a hospital ward. After one patient has shown such a dyspneic attack others disposed to suggestion soon show similar attacks. Continued polypnea is found in pneumonia before crisis, in abscess of the lung, in pulmonary gangrene and tuberculosis, in tumor of the pleura, in meningitis, carcinomatous asthenia, and the symptom-complex of Kussmaul. In the two last-mentioned cases the frequency may also be decreased.

Decreased Frequency.—The frequency of respiration, without signs of dyspnea, is decreased in the beginning and at the fatal termination of stenoses in the great air passages, in bronchial asthma, fibrinous bronchitis, pneumothorax, mediastinal tumor; farther, in different cerebral processes, as extensive brain hemorrhages, cerebellar tumor, and purulent meningitis in the posterior cranial fossa (Macewen); farther in diabetic coma, in the course of some infections and intoxications, in uremia, severe anemia, and sometimes in the agony. This lowered irritability of the respiratory center is also manifested in the irregularity of the breathing. Through the accumulation of carbon dioxid in the blood a greater stimulus is necessary to produce a respiratory movement.

Biot's Respiration.—In general two types of respiration are observed. Biot's breathing consists of the occurrence of a few, three or four,

regular respirations which are followed by a pause of a few seconds, at most fifteen (L. Hofbauer).

Cheyne-Stokes Respiration.—Cheyne-Stokes respiration is characterized by very superficial respirations following a pause, which gradually deepen and again become superficial until they again give way to a new pause in respiration. Beside the intermittent type there also exists a remittent form, without complete apnea.

Both types of breathing are observed in affections of the brain. Biot's respiration especially in meningeal exudates of the posterior cranial fossa and in Basedow's disease (L. Hofbauer); the Cheyne-Stokes type in meningitis, apoplexy, and in different diseases of the respiratory and circulatory organs, as cardiac asthma, emphysema, gangrene of the lungs, also in diabetes, arteriosclerosis, and contracted kidney. Loss and recovery of consciousness are sometimes associated with the two periods of Cheyne-Stokes respiration. With the respiratory pause the pupils contract, and the pulse becomes slow. When breathing commences again, the pupils dilate, the pulse beats faster, consciousness is regained, and patients have the subjective sensation of dyspnea. In many cases they say they have been awakened from sleep by dyspnea. In cardiac and renal diseases this condition may last for months, and then is of no fatal significance.

Morphin may augment this symptom under certain conditions, and in some cases may even provoke it.

There are many theories which endeavor to give an explanation for Cheyne-Stokes respiration; it is certain that there exists a lowered irritability of the respiratory center for the carbon dioxid stimulation of the blood.

Irregular alterations of frequency are present in all diseases with painful respiration, in Basedow's disease, in cerebellar tumor and abscess, in meningitis, diabetes, pulmonary tuberculosis, mediastinal tumors, emphysema, pulmonary abscess, and putrid bronchitis.

Abnormally deep breathing is found in uremic and diabetic coma, in Basedow's disease, in bronchial asthma, in carcinomatous asthma, and in hysteria; abnormally superficial breathing in pleurisy, pneumonia, tuberculosis, diabetes, Basedow's disease, and in those forms of cardiac dyspnea in which severe cyanosis and mechanical difficulty of respiration have not yet arisen (congestive bronchitis, hydrothorax, ascites).

Respiration in the New-born.—Heubner states that the first respiration in the new-born is irregular, that the self-regulation is established only gradually. Therefore increased frequency or irregularity of the respiration is of less importance in infancy.

The new-born make 30 to 60 respirations in the minute, in the second year 25 to 30, and in the following years the frequency reaches

gradually that of the adults. The type of respiration is, in infancy, diaphragmal, in childhood costal, as it remains later on in women; in men the abdominal type prevails.

Symptomatology of Dyspnea.—*Inspiratory.*—Dyspnea, difficult respiration, is to be recognized through the participation of the auxiliary muscles, whose action is not required in normal respiration. If the dyspnea is inspiratory the musculi scaleni, cucullares, levatores scapulæ, sternocleidomastoidei, occasionally also the muscles going from the hyoid to the larynx and from the larynx to the sternum, are set in action. The serrati anteriores and pectorales may also take part in inspiration, but in this case the shoulder girdle and the humerus must be fixed. The action of these muscles must be modified, that their point of bisection which usually acts as the mobile part (punctum mobile) is fixed, and the insertion on the thorax can be used to assist in the elevation of the thoracic cage. Thus patients with a high grade of dyspnea support their arms in order to gain the assistance of these muscles. The same thing can be seen in children who, during a severe attack of whooping-cough, grasp at everything with their arms to effect a deep respiration. The effort to fix the spinal column leads to orthopnea, the typical position necessitated by severe dyspnea.

Expiratory.—In the expiratory form of dyspnea the musculi recti and the whole abdominal musculature in general contract in such a way as to produce the expiratory position of the thoracic cage; but also in inspiratory or mixed dyspnea we occasionally find the musculi recti contracted, in order to hasten expiration, and so to prolong as much as possible the time for the hindered inspiration. The recti may act as inspiratory muscles; if the intestines are fixed through tension of the abdominal musculature, the diaphragm cannot flatten its summit and the contents of the abdomen form a support for the elevation and expansion of the inferior aperture of the thorax (Hoffmann). We see this in severe forms of emphysema.

It may be mentioned that in dyspnea of long standing the organism becomes, to a certain degree, accustomed to it, and the disappearance of the subjective sensation of air hunger may not always mean a compensation of the dyspnea.

It is also not impossible that with the decreased absorption of oxygen the tissue works more economically, and thus a decrease of metabolism results (v. Noorden). The question whether poisonous substances are thereby accumulated in the blood, leading to a pathological catabolism of the protoplasm has not been fully decided.

Prognosis of Dyspnea.—The prognosis of dyspnea generally depends little on the subjective feelings of the patient, but chiefly on the degree to which the auxiliary muscle action covers the oxygen

demand of the organism; in other words, the prognosis in dyspnea is dependent on the degree of cyanosis which accompanies it.

II. SPECIAL PATHOLOGY AND THERAPY OF DYSPNEA

Febrile Dyspnea.—Rapid and deep respiration is found in any feverish condition. The irritation which the warm blood exerts on the respiratory center may be responsible for this symptom, since on overheating of the body, dyspnea may promptly be produced experimentally. The same noxæ which caused the rise of temperature may also lead to stimulation of the respiratory center. This may be seen from the fact that in different diseases of the respiratory organs the curves of respiration and temperature do not always go parallel.

Still another explanation for the fever dyspnea is plausible, namely, that in increased production of heat the demand for oxygen is also increased.

Nasal Dyspnea.—Different affections of the nose may lead to disturbances of respiration chiefly in infants, where the nasal ducts, normally very narrow, may easily be closed up through swelling. The resulting respiratory disorder is chiefly noticeable on nursing, when breathing through the mouth is impossible, and leads more to a disturbance of nutrition than to dyspnea. Thus a child with a slight cold may show a not inconsiderable loss of weight. For the treatment of this condition compression of the nasal channels with cotton wadding for fifteen to twenty minutes has been recommended; it is advisable to saturate the cotton with borlanolin or borax glycerin.

At a later age chronic rhinitis, polyps of the nose, hypertrophy of the turbinates, septum deviations, and tumors of all kinds may become a hindrance to respiration, but usually only on physical exertion and during sleep. Suitable treatment will generally give relief in these cases.

Attacks of dyspnea reflexly produced by these affections will be taken up in the chapter on asthma.

Before the discovery of the rhinoscleroma bacillus, Stoerk had described a chronic blennorrhea of the nose, larynx, and trachea, and it is to-day not entirely decided if this condition is in all cases identical with that of rhinoscleroma. This condition consists of proliferation and shrinking of the connective tissue, progressing from the mucous membranes of the nose to the larynx, trachea, and bronchi, and may lead to severe disturbance of respiration if the vocal cords begin to grow together.

The treatment consists of dilatation with tin bougies, introduced into an opening produced by tracheotomy, or with hard-rubber tubes

through the mouth. But in some cases even tracheotomy will be futile, as the disease does not stop in the trachea, but progresses constantly downward.

Adenoid Growths.—Swelling of the pharyngeal tonsils is a frequent cause of hindrance to respiration in childhood until puberty, but scarcely at more advanced age. Since the patients are unable to breath through the nose, they always keep their mouth open, especially on physical exertion. They snore during sleep and sleep very restlessly with open mouth, owing to the dryness of the oral mucous membrane. Many cases of pavor nocturnus, the night terrors of children, are caused by adenoid vegetations. The diagnosis is usually made at the first glance, the long prognathous face with the constantly open mouth being very striking. Inspection of the oral cavity shows that the arch of the palate is very high, more similar to the Gothic than to the Roman arch, which is normal. We learn, on introducing the finger behind the veil of the palate into the upper wall of the pharynx, the extent and position of the vegetations. In larger children we may see them on posterior laryngoscopy.

Extirpation is advisable for various reasons. Such children usually suffer from rhinitis which sooner or later leads to descending catarrhs of the air passages, and later on to asthmatic attacks. Headaches, inability to concentrate the attention, catarrh of the Eustachian tubes, and difficulty in hearing may be the sequelæ of the failure to operate.

Tonsils.—Less frequently, respiratory disorders are due to chronic hypertrophy of the tonsils. They should be removed by tonsillotomy.

Tonsillar abscess leads very frequently to pronounced dyspnea, even in adults with a roomy pharyngeal cavity. In the first stage one may try to give relief by the external application of cold, by cupping behind the angle of the jaw, and by the giving of ice by the mouth. If we do not succeed in this way we will try to soften the hard infiltrations by warm poultices. When the dyspnea has become threatening the abscess should be opened by incision even if no pus is suspected, since this incision, though very painful, relieves the tension and the discomfort.

Retropharyngeal Swelling.—Especially in children the retropharyngeal abscess and the nonsuppurating hypertrophic lymphadenitis of the retropharynx are not infrequent causes of severe hindrance to respiration. The clinical picture in these cases may be very similar to that of laryngeal croup, only the inspiratory stridor in laryngeal croup is of a more sawing character than in the retropharyngeal abscess.

As soon as the abscess is diagnosed it should be opened. One uses for this a specially constructed knife, or a scalpel that is covered as

far as the point with adhesive plaster. Monti advises the insertion of a sharpened Lister's needle holder, under guidance of the left index finger into the fluctuating part, and then by opening it, the dilatation of the wound. By the right index finger covered with sterile gauze, the pus is expressed from the abscess. In this way the danger of suffocation is removed, but during the next few days the child must be examined frequently, in order to prevent a new collection of pus in the pockets of the abscess cavity. Even in the absence of fluctuation or in the nonpurulent hypertrophic lymphadenitis, it will be safest to relieve the tension by an incision and thus prevent the danger of edema of the glottis, a condition in which any loss of time may be fatal.

Retropharyngeal abscess occurs also in adults, who, on account of their great discomfort, generally seek medical attention before their condition has become critical. These are usually burrowing abscesses following caries or periostitis of the cervical vertebræ or they may be due to the burrowing of the pus of a purulent otitis media, an etiology which plays a part also in many retropharyngeal abscesses in small children.

The respiratory disorders sometimes remain in the background, and the difficulty on swallowing, especially the difficulty of the infant to nurse, may be the cause for seeking medical attention. One must never be satisfied with inspection of the pharyngeal cavity, but always make a digital examination since the abscess may be retroesophageal and not retropharyngeal.

Affections of the Larynx.—*Laryngitis.*—Diseases of the larynx are one of the chief causes of dyspnea. The common acute laryngitis, if severe and infiltrating the submucosa, gives rise to symptoms of stenosis in the same way as swelling of the epiglottis, in which the laryngoscopic picture of the epiglottis bears a certain similarity to that of the portio uteri.

On account of the narrowness of the larynx in infancy one would expect swelling of the epiglottis most commonly in infants, but in fact it is usually not observed until the fourth or fifth year. On account of the peculiar anatomical structure of the mucous membrane of the vocal cords, the swelling is chiefly limited to the loose mucous membrane on the under surface of the vocal cords, and in the laryngoscopic picture one sees dark red protuberances under the discolored swollen vocal cords.

The picture of laryngitis with laryngo-stenotic attacks is usually the following: Children who are rather well during the day, perhaps slightly hoarse, waken after several hours of quiet sleep with the signs of severe dyspnea. The retractions of the jugulum, epigastrium, and lateral portions of the thorax prove that the entrance of air

is very much impeded and that we do not have to deal with air-hunger of nervous origin. The larynx moves up and down with respiration, a marked stridor is heard on inspiration, the children are aphonic, their cough barking and croup-like, and they show the picture of greatest anxiety. Generally they calm down after a short time, awakening in the morning, apparently quite well. In the following nights the attacks are repeated with gradually decreasing severity.

It is hard to explain this condition. Heubner believes that nervous factors play a certain part and that we have chiefly to deal with vasomotor disorders. v. Schrötter believes it to be a spasm of the muscles closing the vocal cords; others believe that the horizontal position favors the appearance of swelling at night; on the other hand, Stoerk sees the inciting factor in the decreased irritability of the larynx as well as in stagnation of the secretion during sleep.

The diagnosis is always rather difficult. In diphtheric croup the sudden onset in full health, is very unusual, the symptoms of laryngeal stenosis increasing slowly and continuously. On the other hand, it would be entirely false to exclude a croupous laryngitis if diphtheric patches were absent in the pharynx, since diphtheria is not infrequently primary in the larynx. If through pressing down the base of the tongue we can get a view of the epiglottis, and we find it free from diphtheric coatings, we may be somewhat more confident in our diagnosis.

The question whether in cases of simple laryngitis intubation or tracheotomy should be performed depends entirely on the severity of the laryngeal stenosis and not on the etiological nature of the disease. In most cases it will be sufficient to supply moist air by hanging a wet linen sheet near the bed, by generating steam in the sick-room, or by allowing the patient to inhale astringents, as an alum solution by means of a spray. These procedures should be performed without exciting the children too much. Sinapism over the cervical region or the application of sponges soaked in hot water and in ice water alternating every half-hour, will soon relieve the discomfort through counterirritation to the skin. Emetics are unnecessary and perhaps dangerous by injury to the cardiac force. Stimulation of the sweat secretion gives good results sometimes.

Phlegmonous Laryngitis.—The phlegmonous laryngitis of childhood is a severe, highly febrile disease, occurring usually in the second or third year of age, and characterized by great variations in the severity of the stenosis as well as in temperature. Laryngoscopically, we find dense swellings, especially under the glottis. External pressure on the larynx is very painful. Local blood-letting and sweating are indicated in this disease, which sometimes is a dangerous complication in measles (Heubner).

In adults, inflammations of the subglottic space lead to laryngeal stenosis, *i.e.*, the hypertrophic submucous laryngitis in both the acute and chronic forms. A prolapse of the ventricle of the larynx sometimes occurs. In other cases, as in the chronic subglottic laryngitis described by Mackenzie, the subglottic space becomes narrowed to a thin cleft. It may be a complication of tuberculosis, syphilis, or rhinoscleroma.

Severe dyspnea may develop. The acute disease must be combated through antiphlogistic measures, ice-bags, counterirritation of the skin, sinapism, and cupping. In the chronic disease, surgical intervention becomes necessary, the protuberances being removed by the galvanocautery or through chemical cauterization.

Laryngeal Croup.—Laryngeal croup is one of the most dreaded forms of laryngostenosis. The diphtheria may involve the larynx, the trachea, the chief bronchi, or their branches, so that tubular formed fibrin masses may be found in the finer bronchi. The question whether a true croup characterized by a fibrinous exudate can occur independent of the Löffler bacillus is of no importance in practice. This condition has been described by the discoverer of the bacillus himself, but occurs so rarely that it deserves no consideration in our therapeutical action.

The treatment of laryngeal diphtheria will be discussed *in extenso* in another place. Here we merely wish to emphasize that in the specific antitoxic treatment we have a means of checking the progress of the diphtheria from the pharynx to the larynx. If laryngeal croup has once developed, intubation or trachectomy will become necessary in some circumstances. If the danger is not imminent, we will try through oxygen inhalations, the application of hot and cold sponges over the larynx, eventually through the use of emetics, and the continual use of a steam spray to bring the child over the forty-eight hours which the antitoxin needs for its action. In any case where a diphtheric laryngitis is suspected it must be used, and best in large doses, 3000 A. T. U. If we expect an involvement of the smaller bronchi, a descending croup, it is advisable to give repeated small doses of about 1500 units, so that the liquefaction of the membranes does not occur too fast and thereby lead to obstruction of the bronchi with following lobular pneumonia. The diagnosis of descending croup is generally difficult since the laryngostenotic stridor drowns all other sounds which might be perceived on auscultation of the thorax. Fine dry râles and a peculiar long, soft, feeble respiration point to the danger of stenosis of the lower air-passages. Also the respiratory frequency may, to a certain degree, serve for or against the diagnosis of a descending croup. In laryngeal croup

we commonly find dyspnea, with retarded frequency of respiration; in the descended croup, dyspnea with accelerated respiration.

Tuberculosis of the Larynx.—Among the chronic diseases involving the larynx, tuberculosis of the larynx produces severe dyspnea only rarely, namely, in its granular form, complicated with necrosis of the cartilages and perichondritis. Very few cases of laryngeal stenosis due to tubercular ulcer are described in children. During pregnancy, laryngeal phthisis usually takes a very unfavorable course and is an indication for interruption of pregnancy.

The therapy depends on the form of the primary disease. Recently Sorgo obtained very good results in the granular form from sunlight radiation. In necrosis of the cartilage the necrotic parts have to be extracted, a perichondrial abscess must be opened, and edema of the glottis removed by scarification.

Syphilis of the Larynx.—Syphilis leads usually in its later forms to laryngeal stenosis, the ulcers causing cicatricial strictures and adhesions. For this form of syphilis the inunction treatment is less efficacious than the internal administration of potassium iodid. The stricture is best removed by the methodical dilatation of v. Schrötter.

New Growths in the Larynx.—The benign new growths of the larynx are usually removed endolaryngeally, whereas the malignant growths can only be extirpated from without through a laryngeal fissure, the total extirpation of the larynx usually being necessary. In childhood the papilloma is the only tumor found, attached to the vocal cords or to the ventriculus Morgagni; it produces hoarseness for years, sometimes causing dyspnea. In this case intubation or complete removal of the tumor through a laryngeal fissure may become necessary. The connection of this affection with syphilis, maintained by some authors, is denied by Stoerk.

Stridor Congenitus.—Thompson and Turner have thoroughly studied the stridor congenitus—a peculiar affection of the first months of life. From birth or a short time afterward, a peculiar inspiratory stridor with slight retractions in the jugulum and epigastrium develops. It is not a very serious condition and disappears of itself in a few months. Its cause lies in a peculiar softening of the entrance to the larynx so that its walls are sucked in in a valve-like manner on inspiration, the aditus laryngis assuming a rhombic form. Hochsinger sees the cause of the congenital stridor in an enlarged thymus.

Edema of the Glottis.—A very serious affection of the larynx, sometimes leading to sudden death, is edema of the glottis. By this we do not understand an edema of the glottis itself, but an edema of the arytenoepiglottic folds. It is usually an inflammatory collateral edema, as in phlegmons, abscess, perichondritis, for instance perichrondritis typhosa, and erysipelas. Sometimes it is brought about by

the use of potassium iodid, together with swelling of the nose and lips, or as a congestion edema in severe general stasis or in local stasis due to compression of the cervical veins by a big goiter. It is found as a complication in nephritic dropsy, and also angioneurotic forms of it have been described. H. Quincke and H. Gross describe a circumscribed "exudation on an angioneurotic basis," which sometimes becomes threatening.

The treatment depends on the primary cause. In the inflammatory form ice may be applied externally or swallowed and cupping performed on the front of the neck over the larynx. Röhle recommends vesicants, eventually hot hand and foot baths. If all these measures do not help, the swollen masses must be scarified through the mouth by means of a small scalpel, protected by adhesive plaster. In cases of severe laryngo-stenosis, intubation cannot be considered, but tracheotomy must be performed. Intervention is usually so urgent that we have no time to make the inferior tracheotomy usually done in croup. Here it is advisable to cut at once through the cricothyroid membrane and the cartilage if necessary. If we have to deal with perichondritis of the thyroid and cricoid cartilages in their anterior parts, Schrötter advises connecting the tracheotomy with the splitting of the cartilages, which at once provides for drainage.

A remarkable case of diffuse chronic edema of the skin with involvement of the larynx is mentioned by Lublinski, which was cured after a year by the treatment with thyroid extract.

Foreign Bodies in the Larynx.—Very dangerous sudden laryngostenotic attacks in children and adults are caused by foreign bodies in the larynx. Their varying positions may produce a purely inspiratory or purely expiratory dyspnea. It has repeatedly occurred that the dyspneic manifestations as a result of foreign bodies have been mistaken for laryngeal croup, and intubation performed in these cases has sealed the fate of the patient by pushing the foreign body into the lower air passages.

Endolaryngeal extraction of the foreign body must be tried in adults under local anesthesia, in children under general anesthesia. If we do not succeed in this way, thyrotomy must be performed.

Laryngeal polyps located below the cords are pressed on expiration against the rima glottidis producing expiratory dyspnea. If they are attached above the cleft they are sucked down on inspiration, inspiratory dyspnea resulting.

Spasm and Paralysis of the Muscles of the Vocal Cords.—Spasm and paralysis of the muscles of the vocal cords may hinder the respiration through the larynx. Spasm of the closing muscles and paralysis of the opening muscles will lead to dyspnea, to severe asphyxia, and indeed to death, while spasm of the opening muscles and the much

more common palsy of the closing muscles lead to hoarseness and aphonia, preventing closure of the vocal cords. This latter affection of the laryngeal muscles may in its further course become a severe hindrance to the respiration, since through it cough may become weak or impossible and severe bronchitis and bronchopneumonia may result through aspiration (postdiphtheric paralysis).

Respiratory Spasm in Children.—In children, especially in the second half of the first year, spasms of the glottis are common, developing apparently from slight causes. We distinguish two types of spasm: the inspiratory, characterized by a crowing inspiration and spastic closure of the cleft, severe cyanosis and convulsions; and the expiratory cessation of breathing, which Kassowitz considers much the more dangerous condition. Most pediatricians believe to-day with Escherich that the laryngospasm is a symptom of tetany. These spasms are found in rachitic children, especially in craniotabes and in those of hereditary nervous dispositon. As exciting factors are mentioned overfeeding, gastrointestinal catarrh, meteorism, flatulent colic, constipation, dentition, and helminthiasis. In some cases it is associated with hydrocephalus.

In Adults.—Adults, too, may have laryngospastic attacks similar to those of children. Hysterical or neurasthenic persons may get such laryngospastic attacks spontaneously or through hyperesthesia if they swallow the wrong way. During an epileptic fit, in lockjaw, in tetany, and in the course of tabes dorsalis, as laryngeal crisis such inspiratory spasms may be observed. Sometimes a tumor pressing on the recurrent laryngeal nerve may be the genetic factor. In children the swelling of tracheobronchial glands may lead to inspiratory spasm from a similar pressure on the recurrent nerve.

Gottstein called attention to a peculiar disposition to inspiratory spasms during pregnancy and menstruation. Interesting is the observation of Stoerk, that even a child on whom tracheotomy has been performed may get a laryngospastic attack.

Laryngeal Crises.—It is not yet determined whether, in the laryngeal crises of tabes, it is a spasm of the constrictor or a paralysis of the dilator muscles of the rima that occurs. Charcot and Krishaber believe it to be a spasm. Oppenheim could provoke an attack by external pressure near the larynx. Charcot showed that a mere touch of the laryngeal mucous membrane might start an attack, and sees in this hyperesthesia the cause of the disease. Such attacks have been provoked sometimes by the act of swallowing and by mental emotions. The laryngeal crises may be followed by paralysis of the vocal musculature. Ruault tried in one case to stop an attack by section of the recurrent nerve, but without success.

Treatment of Nervous Laryngeal Disturbances of Respiration.—In

the treatment of all these spastic conditions, the primary disease has first to be combated. In the spasms of children due to overexcitability, cod-liver oil with phosphorus is given. In urgent cases sodium bromid and chloral hydrate (in enemas) or inhalations of chloroform during an attack must be given to remove the danger to life. If chloroform is not at hand, rhythmic traction on the tongue (Laborde), the introduction of a Nélaton catheter into the larynx, at any rate artificial respiration have to be tried. The last may be successful even when respiration has ceased for several moments. All these endeavors, however, must sometimes be continued for quite a time until the respiratory action has again begun.

In respiratory apnea all efforts are often in vain; even tracheotomy is useless, since the hindrance to respiration is central, a condition against which we are powerless.

If hysteria or neurasthenia is at the basis of the condition, suggestive treatment is indicated, eventually strong faradization of the larynx, and the administration of bromids internally to combat the general irritability of the nervous system. In some cases hydrotherapy and treatment in a sanatorium will have the desired success. In hyperesthesia of the laryngeal mucous membrane and in the laryngeal crises of tabes, local anesthesia with a 5 to 10 per cent. cocain solution will give relief.

Paralysis of the muscles closing the larynx is found in all central processes which injure the tracts of the vagus and accessory nerves; further, in hysteria and in the coma of acute and chronic infectious diseases, in chronic intoxications with lead and alcohol, and also in all injuries involving the peripheral parts of the vagus and the accessory nerve. In most cases the muscles closing the rima of the glottis are paralyzed, producing aphonia, and only seldom do we have to deal with the dreaded paralysis of the dilators of the vocal cords, the paralysis of the posterior branch of the inferior laryngeal nerve.

The treatment will depend on the primary disease. In the most severe cases intubation or tracheotomy will be necessary to preserve life; endolaryngeal galvanization of the posterior branch has been tried repeatedly, in order to restore its function but without success. Indeed, this treatment is entirely inadvisable, for communicating loops of the current may meet the intact closers of the vocal cords, and on each trial to stimulate the posterior branch the closers become still more contracted, leading to the most severe dyspneic attacks.

Diseases of the Trachea.—*Goiter.*—Through obstruction of the lumen of the trachea, whether by proliferation of neoplasms or through foreign bodies, stenosis of the trachea may be produced. The common cause of tracheal stenosis is, however, compression by tumors, most frequently by goiter. The goiter leading to severe

stenosis may be congenital, extending often behind the esophagus. Further, those goiters which develop very rapidly (acute struma) cause severe dyspnea.

The danger lies in the hindrance to respiration from the narrowing of the lumen of the trachea, and, in higher degrees of pressure stenosis, the stridor may be heard at a great distance. Pressure on the recurrent nerve may paralyze the posterior branches and in this way increase the dyspnea. At first the dyspnea is only recognized in the presence of an intercurrent bronchitis; later on, on forced respiration, as on climbing stairs, until finally it is present even on complete rest. If, then, such patients fall sick with bronchitis, the air-hunger may become so threatening that tracheotomy alone can save the life of the patient. The retrosternal or retroclavicular goiter (goitre plongeant) which rises above the manubrium of the sternum at each respiration, leads to the severest form of dyspnea when this movement is hindered by adhesions.

Wölfler distinguishes from the goiter plongeant the wandering goiter which, situated high up on the trachea, may, through its great mobility, fall behind the manubrium and compress the trachea. In these cases the trachea also is able to make rather free excursions.

Yet even those goiters which are entirely movable may, if they are very extensive, lead to a displacement and narrowing of the trachea, which Demme has compared with the sheath of a saber, since the trachea is flattened out from both sides in a sagittal line. If the pressure brings about atrophy of the cartilages of the tracheal rings, the compression becomes more intense, and stenosis may persist even after strumectomy has been performed.

There is another way in which the respiration may be hindered by goiter: the muscles which lie over the thyroid gland may press it against the trachea, producing asphyxia, which itself again increases the tension of the muscles, and this vicious circle is supposed to be the cause of sudden death in goiter. Ewald, on the other hand, disbelieves this causal connection, since the muscle tension decreases if the dyspnea is very severe, and renders respiration easier. Attacks of sudden dyspnea, the so-called goiter asthma, in many cases is certainly brought about by compression of the recurrent nerve. In acute inflammation of the struma, edema of the glottis may arise from stasis or as a collateral inflammatory edema, and produce severe asphyxia. Malignant growths, not only by compression of the trachea, but also from extension over it and proliferation into its lumen, may cause severe dyspnea.

The treatment of goiter depends on its pathological form. In the parenchymatous goiter, iodin sometimes gives good results. It acts, if given internally, as well as if the tincture, or Lugol's solution

or an iodin ointment is applied. Injections of iodin in cystic and colloid goiter are scarcely more used. The thyroidin treatment has spread remarkably in recent times, since it was learned that also other degenerative changes of the thyroid gland could be improved by thyroidin. The preparations of Parke, Davis & Co., in Detroit, of Burroughs, Wellcome & Co., in London, or of Merck, in Darmstadt, deserve recommendation. One may give three tablets *pro die* without fear of any disturbances, and to infants half a tablet, yet nervous disorders or marked loss of weight are occasionally seen. Reinhold prefers to give the fresh sheep gland, 6 to 7.5 gm. *pro dosi*, and Mikulicz obtained good results from the use of the thymus gland. The troubles which the great colloid or cystic goiters produce can only be relieved by the hand of the surgeon.

Thymus.—The possibility of compression of the trachea by a large thymus has been much discussed without a final decision on this question having been reached. It is a fact that a very large thymus may endanger life, however rare this condition may be. In most cases we do not have to deal with compression of the trachea, but rather of the vena cava or with a reflex spasm of the glottis. In sudden death in children with hyperplasia of the thymus, the status lymphaticus associated with this condition deserves our consideration as a causal factor in the death.

Aneurysm; Lymphomata.—The most important cause of compression of the trachea and still more of the great bronchi are aneurysm of the ascending aorta and lymphomata situated at the bifurcation. Very frequently this condition is found in children who, after measles, influenza, and pneumonia, as well as chronic simple bronchitis, show a swelling of these glands, and with it a peculiar stridor which has to be well distinguished from laryngeal stridor. The voice is of a peculiar bleating character (polichinelle voice of Simon), the cough has a high metallic note, a slight dulness is found posteriorly and anteriorly on both sides of the manubrium, and on auscultation of these regions a peculiar sharp pressure respiration. The X-ray picture shows a round shadow corresponding to the glandular tumor.

The internal administration of potassium iodid, inunctions with unguentum cinereum or green soap may cause the disappearance of this affection in a few weeks. A tracheo-bronchial stenosis is often caused by tubercular glands, and if one of these perforates into the trachea a sudden, severe asphyxia or even death may result. In children with swelling of the bronchial glands, attacks similar to whooping-cough are not uncommon; these inspiratory spasms are probably due to compression of the nerves.

Tracheal Stenosis during and after Tracheotomy.—Other forms of tracheal stenosis are observed during tracheotomy and on removal

of the tracheal cannula. Asphyxia may arise during the performance of the operation if the larynx is bent too far backward; in this way the lumen of the trachea, already very much narrowed through disease, is closed completely; this closure of the lumen may be produced by a membrane which, not having been cut through on the introduction of the cannula, is pushed ahead of it as a barrier. On little practice in the performance of the operation one may neglect to divide the mucous membrane entirely, so that the cannula is introduced into a pocket between the mucous membrane and the tracheal wall. In this case the tube must at once be removed and the tracheal wound opened by hooks in order to find the cause of the hindered respiration. If during the performance of the tracheotomy the patient becomes asphyctic, by no means should artificial respiration be performed until the tube is perfectly situated in the trachea. The operation must be carefully continued until completed, and then there is still time to save the life by continual artificial respiration and heart massage.

The removal of the tube may be complicated owing to different circumstances and lead to tracheal dyspnea. If the tube employed is relatively too large for the wound, necrosis of the cartilages is produced and the anterior wall of the trachea loses its elasticity and retracts at each inspiration. A further hindrance to its removal lies in the granulations which arise and lead to obstruction in the tracheal lumen, especially on the use of the so-called speech tubes, but also on the use of the common cannulas if they are not changed frequently enough. The removal of the cannula is only possible when the granulations have been removed with a sharp spoon or by means of the caustic pencil. The appearance of granulation may be recognized when the tube is still in place by coughing spells and by traces of blood in the sputum. Granulation may be prevented by performing the tracheotomy as low as possible, since the tendency to the formation of granulation increases with the proximity to the larynx.

Violent dyspnea may arise on removal of the tube, nevertheless no mechanical hindrance to respiration exists. This is due to the fact that nervous children have forgotten how to breathe through the larynx, and from the excitement caused by removal of the tube they get a spasm of the glottis. In such cases it is advisable to use the above-mentioned "speech" tubes which allow respiration through the larynx by closing the end of the tube with a stopper. After a child has slept one night with the tube closed it may be removed without difficulty. Sometimes it may become necessary to decrease the nervous irritability in general, and especially of the respiratory center, through large doses of sodium bromid and codein and then to remove the tube with the patient in a semi-comatose condition.

Diseases of the Bronchi.—*Bronchitis: Forms of Dyspnea in Bronchitis.*—The dyspnea in bronchitis may be of various forms (Sahli). If certain regions of the lung are obstructed through severe swelling of the bronchial mucous membrane, the respiration becomes accelerated, since in this way the healthy parts of the respiratory surface which are accessible to the air are stimulated to increased function. But if all the smaller bronchi are equally obstructed, respiration becomes slowed, this retardation being the only means left of overcoming the hindrance to respiration. If the obstruction of the bronchial tube is general, and so severe that the retarded respiration can no longer relieve the dyspnea, the respiration becomes again accelerated. The type of the dyspnea is chiefly expiratory, in opposition to the laryngeal type, which involves chiefly the inspiration. From all this it results that the different kinds of bronchitis show marked differences in regard to dyspnea. The severe bronchitis during the course of typhoid fever involves at once the capillaries, whereas the capillary bronchitis of measles descends gradually from the great bronchi into the smaller ones.

Fibrinous Bronchitis.—Another type of bronchitis producing severe hindrance to respiration is the fibrinous form. It may develop after inhalation of irritating vapors (ammonia), in the course of diphtheria, measles, scarlatina, typhoid fever, croupous pneumonia, tuberculosis, and various affections of the heart, but also idiopathically. The dyspnea is one of the most pronounced symptoms, being continuous or occurring in attacks. Both phases of respiration are prolonged and flattened, the auxiliary muscles participating in expiration. Spirals are rarely found in the sputum, more frequently asthma crystals.

Therapeutically, a spray with chalk-water may be used, since the expectorated coagula of fibrin are readily soluble in it.

Putrid Bronchitis and Bronchiectasis.—Putrid bronchitis and bronchiectasis are not especially distinguished by dyspnea; in the former, in distinction from the other forms of bronchitis, L. Hofbauer found differences in the depth of respiration; on the other hand, severe dyspnea exists in every bronchitis of children on account of the narrowness of the air-passages. Even the simple tracheo-bronchitis may often produce expiratory dyspnea, and Heubner states that this symptom, especially in nervous children, is very pronounced. Against this he advises the administration of emetics, unless contraindicated by a tendency to collapse. He obtained good results from the sulphate of quinin in doses of 0.02 to 0.15 gm., according to the age.

Chronic Bronchitis.—The chronic bronchial catarrh leads sometimes in early childhood to pronounced asthmatic disorders. The

thorax is rigid, and A. Freund therefore sees the cause of this condition in changes in the costal cartilages. The dyspnea is expiratory and we have probably here, as in the asthma of adults, a primary spasm of the bronchial musculature with a secondary emphysema. The expectoration is scanty, sibilant râles are heard over the lungs, especially on very prolonged expiration. The dyspnea may be so severe sometimes that the patients remain for several days in continual orthopnea.

A carefully carried out cold-water treatment, a sojourn at the sea, and respiratory exercise as recommended by Gobhardt, consisting in compression of the thorax at each expiration, have first to be tried in the treatment. Iodid of potassium is sometimes useful, though the tolerance for this drug must first be tested. Therefore it should first be prescribed in a 2 per cent. solution, a tea or tablespoonful every two hours, and only gradually increased.

Capillary Bronchitis.—Capillary bronchitis of children, the catarrhus suffocativus of the old authors, is a very much dreaded disease in the first two years of life, numbering many victims among rachitic children and after influenza. Some cases have been observed following anesthesia. If a common bronchitis develops into a capillary bronchitis, it is first recognized in the general condition and not by the physical findings. The child becomes extremely pale, the respiration very fast and difficult; a livid discoloration is associated with the pallor, and the insufficient access of air is seen in the retraction of the lateral parts of the thorax and of the epigastrium, and in the so-called "flank" respiration. In the further progress, fine vesicular râles are heard, as are occasionally found also in miliary tuberculosis. The anatomical findings show lobular pneumonic foci, together with vicarious emphysematous portions.

The treatment consists in mustard-water packs, which Heubner prefers to the mustard baths. A few handfuls of ground mustard are put into a bag which is shaken in a wash-bowl of warm water, until the development of the mustard oil is recognized by the irritation of the lacrimal glands. A sheet is then dipped in this water, wrapped around the child, and covered by a dry sheet. It is then held tightly around the neck to protect the mucous membranes against the stinging vapors. After twenty minutes at the longest, the child is taken out of the pack and placed in a warm bath, with cold douches on the chest, neck, and back. In very full-blooded children with severe dyspnea venesection gives good results. In small children this procedure is not as simple as in adults, since the stasis of the venous blood in the arm does not cause the vein to protrude very plainly. The vein must be freely exposed before it is opened.

The use of emetics doubtless gives relief sometimes, but a too free

use of them is not advisable on account of the danger of collapse. One will rather prefer expectorants in moderate doses: the infusion of ipecacuanhæ, 0.2 to 0.5 to 70 water, a teaspoonful every two hours, or the decoction of Polygalæ senegæ, 5.0 to 70 water, in the same dose, or 5 to 10 drops of liquor ammonii anisati every two hours.

Capillary bronchitis may exist subacutely for a long period, especially in rachitic children following measles and pertussis; living in unhealthy locations seems to prevent the healing of this condition. The children cough, are dyspneic, and show, especially in the evening, febrile temperatures. The capillary bronchitis is not found in the whole lung as in the acute process, but is limited to certain lobes, which speak for the fact that the process was at first diffuse and has left behind certain unhealed rests. The differential diagnosis from tuberculosis is often very difficult, and indeed even impossible in these cases; also from catarrhal pneumonia, as both diseases may exist together.

The treatment will consist in the improvement of the hygienic conditions, in fresh air, appropriate food, warm baths with cool douches, and the administration of expectorants.

Pertussis.—Very transient but constant findings in the attacks of cough in pertussis are inspiratory spasms and momentary interruption of respiration, with severe cynosis. Cases are reported of patients who have died from asphyxia during such an attack, but this is certainly very exceptional. We are almost powerless against whooping-cough. The most valuable drug, according to most authors, is the sulphate of quinin, which should be given in large doses; to a two-year-old child, for instance, 2 gm. quinin sulphate: 120, a dessert-spoonful every one or two hours. Also antipyrin (0.2 to 0.5 gm.) and antifebrin (0.3 to 0.1 gm.) occasionally give relief. Rehn praised the mandelic acid antipyrin, called tussol. It is given in doses of 0.03 to 0.5 gm. three to six times a day. Further bromoform in doses of 2 to 5 drops, two to three times a day. Frühwald accomplished good results with antispasmin. It consists of narcein natrium and natrium salicylicum, and is given in doses of 3 to 20 drops three to four times daily, according to the age of the child.

If the attacks are very frequent, one must try to give the patient rest, at least for some time, through chloral hydrate, codein, or by painting the larynx with a 2 per cent. cocain solution. The number of internal remedies advocated in pertussis are numerous. Inhalations with various antiseptics are praised, but have little success, as Baginsky emphasizes especially in regard to the carbolic acid inhalations.

It is important to know that in an infant, and often in the adult, whooping-cough does not show the characteristic crowing inspirations

(whoops). In such atypical cases the cough is a short staccato, and expiratory apnea and severe cyanosis are present. For the whooping-cough of small children it is farther characteristic that they expectorate abundantly, whereas children in the first years of life otherwise produce scarcely any sputum. This fact alone is sufficient to arouse one's suspicion of an existing whooping-cough. The combination of laryngospastic attacks with pertussis is important, but is much more rarely observed in the first years of life than later on, although at this time laryngospasm is frequent.

Pneumonia.—Croupous pneumonia leads to pronounced in- and expiratory dyspnea, independent of the extent of the infiltration, and even with very small, scarcely demonstrable foci.

The conditions are similar in pulmonary abscess, but the respiration is dependent on the position of the body, in accordance with the change in the drainage.

In some cases of pneumonia, tachypnea alone is present, the respiration being accelerated but not difficult. In the farther course, the disease may extend, but the dyspnea, nevertheless, decrease, a fact of which we shall speak later on, in analogous conditions. Severe dyspnea is found in croupous pneumonia only if several lobes are in a state of hepatization or if severe complications exist, as scoliosis, extensive diffuse bronchitis or edema of the lungs. The respiratory frequency in adults varies between 24 and 40 in the minute, children may have 50 or more respirations without implying a bad prognosis. In adults, however, a frequency of 60 respirations will, of itself, render the prognosis serious. This high degree of tachypnea found in miliary tuberculosis, is not common in croupous pneumonia. If the respiration becomes very difficult, as we see, for instance, by the vibrating nostrils, we have to consider the prognosis unfavorable. That the dyspnea is not dependent on the extension of the infiltration alone may be seen in the peculiar fact that evening rises in the respiratory frequency may be observed which are not parallel with the evening temperature.

A generally accepted specific against the pneumonic process does not exist at present. Römer has prepared a polyvalent bactericidal pneumococcal serum manufactured by Merck, in Darmstadt, of which 20 c.c. are injected in the same way as all serum injections. Several authors report encouraging results from this serum, the subjective condition of the patient seeming especially improved. Success can only be expected in infections with the diplococcus of Fraenkel-Weichselbaum, and not in such with pyogenic cocci, influenza, and Friedlander bacilli. Baths with cool douches on the neck are an excellent method of improving the cardiac force and favoring the expectoration, and also of relieving the dyspnea. The methodical

partial baths in the treatment of pneumonia, as used by A. Pick, have the advantage over the full bath of not exhausting the very ill patient through the transport and exertions inevitably connected with the bath. By this method, as Pick and Nespor have related, the same effect is obtained as from a bath which is cooled from 30° C to 27.5° C., in which the patient remains for eight minutes. The technique is as follows: Each part of the body, first each arm, then each leg, then the anterior and posterior portions of the trunk—altogether six procedures —are wrapped in a wet towel and rubbed until reaction is obtained, that is until the skin feels warm; then the portion is wrapped in a dry towel, and carefully rubbed until dry. This procedure of the wet rubbing is immediately repeated three or four times, and about four times a day. With this procedure very favorable results have been obtained, the patients feeling very much refreshed. Statistics, though viewed skeptically, show the undeniable effect of this treatment.

Morphin will have to be used occasionally, to relieve the discomfort of the patient, especially that due to dyspnea. The cardiac force is not unfavorably influenced by it and the respirations, especially if hindered by pleuritic pain, becomes visibly freer and easier. If pulmonary edema is imminent or other symptoms speak for deficiency of the cardiac force, as, for instance, weakness of the second aortic sound, bad filling of the radial artery, and abnormally high pulse frequency, wine, strophanthus, digitalis, ether, and camphor will be indicated.

The croupous pneumonia of children does not show much deviation from the course in adults. It is quite frequent in the first two years and has a high mortality in the first year, 25 per cent. as against 2.3 per cent. in later years (Riviere).

Toff recommends kreosotal very highly, giving 1 gm. per diem. in the emulsio oleosa, to children under two years; older children receive half as many grams a day as they have years.

If the cough is very troublesome, Henoch advocates minimal doses of morphin, without hesitation, even to very small children. For instance, for a child of three to four years, 1 mg. In very severe dyspnea cupping or venesection (about 50 c.c.) may be performed to relieve the air hunger. Of course the mistake of former centuries, to perform venesection in each severe pneumonia must be avoided, and it must be limited to very plethoric persons with severe dyspnea.

Bronchopneumonia usually shows a higher respiratory frequency than the croupous form. Sixty respirations in adults and 80 in children are not rare. In the catarrhal pneumonia of very cachectic patients the respiration, curiously, shows no marked increase. The oxygen requirement of these individuals is probably so low that even the diminution of the respiratory surface which occurs in catarrhal

pneumonia does not necessarily lead to dyspnea. In the course of the bronchopneumonia of children, the severest degrees of dyspnea and orthopnea are found, and the children sit up the whole day in their beds. In a typical rachitic thorax, retractions may be produced from the insufficient access of air into the lungs, which misleads one into making the diagnosis of croup. It happens probably in every children's hospital that children brought in with the diagnosis of croup often have a severe catarrhal pneumonia.

The prognosis in these conditions, if they are very pronounced, is unfavorable. Analeptics, warm baths with cool douches, the above-described mustard packs, and oxygen inhalations are tried. Heermann recently advocated artificial respiration for half an hour, several times a day. According to his experience, respiration is deepened, expectoration increased, and the carbon dioxid intoxication improved.

Embolism of the Lung.—Emboli in the pulmonary artery lead to sudden death in most cases. We have to be prepared for them in all those diseases which are associated with coagulation in the venous system and in the right heart. Their occurrence is not very frequent, however, and may often be avoided by refraining from any kind of movement; for instance, in a patient suffering from thrombosis of the femoral vein. If the chief branch of the pulmonary artery becomes obstructed the patient usually dies suddenly after a few seconds of dyspneic breathing. If smaller branches of the pulmonary artery are obstructed, dyspnea, pain, cough, and the typical bloody sputum of the hemorrhagic infarct are the clinical manifestations. Death cannot always be explained by the obstruction to the circulation alone, but perhaps by the reflex stopping of the heart as a result of the stimulation of the ends of the vagus in the lung. For in phthisical patients the respiratory surface is often enormously reduced and, nevertheless, the symptoms of dyspnea are not very severe.

Miliary Tuberculosis.—In miliary tuberculosis, a very marked dyspnea, chiefly expiratory, is the rule, with variations in the depth and duration of respiration, and a high respiration frequency, in adults 40 to 60, in children 90 per minute. Ruehle believes the dyspnea to be caused by irritation of the pulmonary ends of the vagus through the disseminated tubercles. The presence of tubercles on the diaphragm may in many cases be the cause of the hindered respiration. However this may be, the diminished respiratory surface alone does not explain a dyspnea of such a degree that constant orthopnea is present.

Emphysema.—In substantial emphysema of the lungs the thorax remains constantly in the inspiratory position. The respiration is only slightly accelerated, the inspiration quite short, and the expira-

tion prolonged; the patient breathes in a peculiar way, the thorax not becoming visibly expanded; and since too little air enters the lungs, retractions may be seen on both sides in the mamillary line; the diaphragm hangs low, the abdominal muscles protrude, at first only on expiration, but in more severe degrees also on inspiration. The form of the asthmatic attacks in the course of an emphysema may be of the type of cardiac or bronchial asthma. For on longer existence of an emphysema, the heart, especially the right side, is constantly affected, which explains the occurrence of the cardiac asthma.

The prognosis of the emphysema depends, in general, as Waldenburg emphasizes, on the vital capacity, as determined by the spirometer. If the vital capacity sinks more than a half below the normal, the prognosis has to be considered unfavorable.

The treatment of the continual dyspnea of emphysematous patients will in the first place aim to improve the ever-present bronchitis which increases. the discomfort of the patient a great deal; sodium iodid should be given, and care should be taken to improve the cardiac force and bring about vigorous expiration. The treatment in the pneumatic chamber is very much used (Lazarus). Patients are exposed to a pressure of one and one-half atmospheres for one-half to one hour, and one may observe that the depth of respiration increases in the chamber, whereas the respiratory frequency decreases. Other authors have recommended expiration in rarefied air and in fact in some cases this renders good service. Inspiration of compressed and expiration of atmospheric air is much more rarely used. Lazarus states that in arteriosclerotic patients the pneumatic treatment is contraindicated. Michaelis has recommended oxygen inhalations. Gerhardt and Strümpell consider respiratory gymnastics very valuable, and the latter has constructed a very simple handy apparatus by means of which the patients compress their own thorax during expiration. Landerer recommends another system of gymnastics which consists chiefly in associating with the inspiratory movements lateral extension of the arms from the thorax, and with the expiratory movements, the pressing of the arms against the thorax. In this way the respiratory movements are made more forceful.

For the immediate relief of severe dyspneic attacks, morphin, codein, heroin, and dionin have been recommended These drugs not only give relief but also exert a varying influence on the depth of respiration, morphin diminishing the respiratory expansion, whereas codein and, still more, dionin increase it. The last, therefore, deserves the preference and should be prescribed in doses of 2 mg. to 2 cg. in violent dyspnea due to emphysema. We should

strive to deepen the respiration the more, as the respiratory frequency is decreased in this condition, at least in a relative degree, *i.e.*, in relation to the other signs of dyspnea.

Edema of the Lungs.—Edema of the lungs is a condition associated with extreme dyspnea. Its causes may be various. Poppert saw it once after an ether anesthesia; it is occasionally found in tuberculosis, rarely in pneumonia, and also after thoracocentesis (Terrillon's "Expectoration albumineuse après la thoracocentese"). It is important to know the aspiration edema, as found in a part of the lung after obturation of its afferent bronchus, as, for instance, through a foreign body or a diphtheric membrane. The inspiratory movements of the thorax lead, then, to rarefaction in these parts of the lung, the air can no longer stream in from the bronchial tree, and thus the serum is sucked out from the blood-vessels. Pulmonary edema is farther observed in whooping-cough, in cardiac affections, and in gout; in the latter, especially in the nocturnal attacks of dyspnea (Clark). Farther, it is observed in renal diseases, in the acute exanthemes and due to a fluxionary acute hyperemia of the lung, in attacks of mania, and in delirium tremens; especially, however, when maniacal patients are subdued with force. Cohnheim made the famous remark that one does not die from pulmonary edema but that pulmonary edema appears when one dies. This assertion certainly is true in the numerous cases of agonal pulmonary edema, but not in all cases, especially not in those forms which recur periodically, and which run a chronic course.

In regard to the prophylaxis of pulmonary edema it must be emphasized that it is not advisable to remove too great a quantity of liquid in an abundant pleural exudate. It is sufficient to draw off 500 to 1400 c.c. exudate slowly, by means of a fine trochar, thereby giving careful attention to the condition of the patient, to his pulse, to the occurrence of coughing spells, or to the appearance of the dreaded foamy sputum. v. Neusser emphasizes in his lectures that if the existence of a chronic, indurative mediastinitis is suspected, thoracentesis may be performed only with the utmost precaution. For if we draw off a large quantity of pleural exudate, the resulting vacuum is not filled by the diseased, compressed lung; but the healthy lung pushes over, and the displacement of the mediastinum beyond the middle line, toward the side of the puncture, can be shown on percussion If now the mediastinum has become immovable through inflammatory processes, the diseased lung alone has to fill the space which has become available through puncture, and since the vessels in the affected lung have undergone pathological changes, transudation takes place into the alveoli.

Pulmonary edema is characterized by dyspnea which may reach

the most severe degree, cyanosis, coughing spells, foamy sputum, poor and irregular action of the heart, and a small filiform pulse.

The treatment must first aim to improve the cardiac force. We will give ether subcutaneously which acts immediately and follow it by a camphor injection whose action appears after one-half to one hour. It is not desirable to give emetics to remove the foamy sputum from the lung, since these tend to increase the collapse. The usual expectorants may be used in small doses. Lead acetate, first recommended by Traube, is frequently given in doses of 0.05 gm. every two hours, but the effect of this drug is not very startling. Sometimes it brings relief through derivation to the intestine. Lenhartz applies synapisms over the whole body for half an hour, reporting favorable results. If the patient is not very much weakened, the pulse not bad, but the cyanosis of a severe degree, then Sticker advises venepuncture, which gives subjective relief almost constantly, and diminishes the cyanosis by unloading the venous circulation. Atropin also may be tried. Sahli has even recommended tracheotomy and the removal of the serous liquid by means of suction on an elastic catheter.

Chronic Pulmonary Tuberculosis.—Chronic tuberculosis of the lung leads to a diminution of the respiratory surface. This develops so slowly, however, that the patient usually grows accustomed to this change, and he assures the physician that his breathing is quite easy and undisturbed. However, as soon as the patient performs the slightest physical work, as climbing stairs, or even talking for a short time, the shortness of breath becomes noticeable, although often ignored by the optimistic patient. Another cause of dyspnea in phthisis is of nervous origin since we know that stimulation of the vagus ends in the lungs leads to dyspnea. It is a special peculiarity of circumscribed tuberculosis in its initial stage that it leads sometimes to such a severe degree of dyspnea that patients are occasionally treated for asthma, and only a very careful examination shows some roughened breathing over the apex. This trouble ceases as soon as the process has healed. One must not think the disappearance of the dyspnea is brought about through a new increase of respiratory surface, as the diseased apex is only a retracted one. Dyspnea becomes more conspicuous in uncomplicated tuberculosis of the lung when the process is rapidly spreading, and in this way may have, to a certain degree, a prognostic significance.

Pressure of caseous bronchial glands on the nerves is, too, sometimes the cause of dyspnea. In other cases the dyspnea is produced by cardiac weakness, inasmuch as clear signs of muscular insufficiency appear, even in the early stages of tuberculosis. Dyspnea is frequently increased after meals, as the full stomach leads to a high

position of the diaphragm. Cornet states that many patients show higher temperatures during the period of digestion, and this, together with the high position of the diaphragm, increases the oxygen requirement.

The treatment of the dyspnea in tuberculosis will depend on the cause. In stagnant expectoration, light exercise is to be recommended to the patient, if he is free from fever (terrain-cure), since this increases expectoration considerably. If we have to deal with asthmatic attacks, sodium iodid in moderate doses is given, as in other forms of asthma. Asthma-cigarettes, stramonium fumigation niter papers, etc., may be used. If swelling of the bronchial glands is suspected, inunctions of the thorax with green soap are sometimes of good service. Phthisical patients are not fit subjects for pneumatic chambers, according to Cornet. In those cases where, in fact, diminution of the respiratory surface is responsible for the dyspnea we have only one means of giving relief to the patient, namely, by decreasing his oxygen requirement through absolute rest (rest-cure). In hopeless cases, the benefit of morphin can scarcely be withheld.

Diseases of the Pleura.—*Pleurisy.*—In pleurisy and tumors of the pleura the expiration is always prolonged, the respiratory pause disappears, and the frequency is at first increased, later on decreased. Dry pleurisy may also lead to dyspnea, inasmuch as the respiration is very painful and is therefore repressed as much as possible by the patient. Therefore diaphragmatic pleurisy, especially, is accompanied by dyspnea, for the action of the diaphragm is not only painful, but becomes insufficient through participation of the musculature in the inflammatory process. If the pleural sac has become obliterated owing to coalescence of the pleural layers, pronounced respiratory discomfort is not necessarily present. This condition is often found at postmortems, though the patient, during life, had never complained of dyspnea. On the other hand, exudative pleurisy is of great importance as a pathogenic factor in dyspnea, since it may lead directly to suffocation by compression of the lung, if immediate relief is not given through partial removal of the exudate (pleural puncture as a life-saving indication).

Purulent exudates, as metapneumonic empyemas, may lead to sudden suffocation by perforating into the bronchial tree. The diagnosis of interlobar empyema is often very difficult, and it is only after repeated exploratory punctures that we succeed in reaching the purulent focus.

Peripleuritis.—Acute peripleuritis leads very early to hindrance of respiration, from its great painfulness.

In the treatment of serous pleurisy the salicylates should be tried,

since it may be of rheumatic origin. If the exudate increases abundantly, the use of digitalis is advisable, but not as a diuretic, as diuretics are of no use as long as the exudate is increasing due to the persistence of the exudative process. For the same reason diaphoresis and restriction of liquids are valueless. In such cases digitalis is indicated only as a heart tonic. If the dyspnea reaches a dangerous degree, or a considerable displacement of the heart indicates danger for life, puncture is not to be delayed longer. For reasons already mentioned, it is well not to remove more than 1/2 to 1 1/2 liters of fluid, with a fine needle. The aspiration apparatus (Potain, Dieulafoy, and others) has to be used very cautiously. A spontaneous absorption of the exudate is often observed, even if only a small quantity of it has been removed. If the exploratory puncture shows pus, we should undertake evacuation, following the rule, *ubi pus, ibi evacua*, even if the quantity of exudate in itself furnishes no indication for puncture. If large, lardaceous coagula are present in the exudate, one will prefer thoracotomy, with or without resection of the ribs. The less we anticipate a good expansion of the lung, the more extensive this resection must be.

The question whether tubercular pleuritic exudates should be operated or not depends on whether the discomfort of the patient from dyspnea is very severe, or whether a vital indication exists. In these cases the evacuation of the exudate must be performed, even if we cannot count on a persistent recovery of the patient through this intervention; sometimes recovery is reached after repeated punctures.

Hydrothorax.—The dyspnea in hydrothorax is usually much more pronounced than in pleurisy, since hydrothorax is usually associated with severe injury of the cardiac force and is most commonly bilateral in occurrence. If a hydrothorax reaches too great dimensions, removal of the transudate will be indicated.

Pneumothorax.—Pneumothorax usually sets in suddenly with the sensation of extreme dyspnea, so that the patient thinks he will suffocate. Vigorous persons have the most severe dyspnea in pneumothorax, while phthisical individuals have relatively little subjective discomfort if the pneumothorax occurs on the side where the lung is for the most part destroyed. If the pneumothorax appears on the opposite side, as happens sometimes, we then find also in tubercular patients the intensest dyspnea, as the other lung is not able to compensate. In the first hours or days after the appearance of the pneumothorax, orthopnea is usually present; shock and collapse may be the first symptoms. In regard to the respiratory frequency M. Kreps found an increase, experimentally, in open pneumothorax, a decrease in closed pneumothorax. L. Hofbauer observed, with Gutt-

mann and Breuer, a diminished frequency of respiration in the rabbit. Clinically, the respiratory curve shows a difference between recent and old cases; in the first, expiration is prolonged and difficult, inspiration entirely normal; in the latter both are prolonged and superficial.

Rosenbach advises not to be too hasty in puncturing a pneumothorax, for this remedy lasts only a short time and may lead to putrefaction. If the pneumothorax is sacculated, it is advisable to perform puncture, provided, of course, that we are sure of our diagnosis. Sometimes thoracotomy will have to be performed, if the exudate is considerable and a tendency to putrefaction exists (Rosenbach). It has been tried to immobilize the affected side by means of a fixation bandage, but success is rarely attained and the patient is unnecessarily molested. Morphin gives the best relief, and may be given unhesitatingly without danger to the heart. If necessary, it may be combined with cardiac tonics.

Affections of the Diaphragm.—The diaphragm, according to Albrecht v. Haller, is, after the heart, the most important muscle of the human body. Spasm and paresis of the diaphragm are very dangerous affections, leading to intense dyspnea. They are discussed *in extenso* in the chapter on the Phenomena of Motor Irritation and Paralysis.

Heart Diseases.—*General Remarks.*—Respiration is dependent not only on the exchange of gases in the lungs, but to the same extent on the circulation of the blood. If the blood is oversaturated with carbon dioxid, dyspnea develops through irritation of the respiratory center in the medulla oblongata. If the rapidity of the blood current through the vascular region of the lung is decreased, the fall from the pulmonary artery to the left auricle being too small, the blood will be insufficiently decarbonized, an insufficient quantity of oxyhemoglobin being formed. Thus we see that the work of the right ventricle has to compensate if the pressure in the left auricle rises, in order to maintain the normal flow in the pulmonary circulation. Jürgensen believes that the exchange of gases in the lungs suffers from increased pressure in the pulmonary circulation, even if the flow and rapidity of the current has not been diminished. To explain the dyspnea which is due to overfilling of the small circulation v. Basch has formulated his doctrine of swelling and stiffness of the lung (Lungen Schwellung und Lungenstarrheit). The lung, abnormally rich in blood, is supposed to become stiff and immovable through swelling. Kraus, however, has proved that cardiac patients sometimes show dyspnea on muscular exertion without any diminution in the respiratory expansion of the lungs being found.

Occasionally we see that weakness of the right ventricle leads to

dyspnea, especially if a hindrance to the circulation exists, as in hyposcoliosis and emphysema. In these cases a diminution of the rapidity of the blood current in the lungs exists; digitalis increases the blood pressure but aggravates thereby the dyspnea. Thus we see sometimes an increase of dyspnea following a treatment with digitalis, especially in chronic myocarditis, in interstitial nephritis, and in sclerosis of the coronary arteries of the left heart. Dyspnea is most intense when the right ventricle works better than the left, but not sufficiently to produce the necessary fall. Then on the one hand we have increased blood pressure in the pulmonary circulation, on the other hand a retardation of the rapidity of the flow.

The clinical symptoms of this form of dyspnea are the following: The patient becomes breathless on any exertion, especially if he acquires a slight bronchitis. A high position of the diaphragm brought about by distention of the stomach may lead to distressing dyspnea. The discomfort gradually increases more and more, leading to the most painful states of dyspnea and anxiety.

There are other theories for the explanation of dyspnea in cardiac affections. Fournier considers toxic influences responsible for it, and Franck thinks that possibly we have to deal with reflex irritation of the respiratory center, starting in the endothelium of the aorta or of the endocardium.

We find attacks of dyspnea, like angina pectoris, most frequently in coronary sclerosis. The patient wakes suddenly at night and hurries to the window, struggling for air; on examination one finds nothing remarkable in the lungs, sometimes, however, signs of pulmonary edema. This may be considered as a congestive edema, but in some cases this explanation is unsatisfactory; for instance, if it is limited to one upper lobe (serous pneumonia of Traube) little by little complications develop, such as bronchitis, brown induration of the lung (heart failure cells), hydrothorax, sometimes pneumonia and pleurisy; these still further increase the dyspnea.

Bronchial and Cardiac Asthma.—In considering the differential diagnosis between bronchial and cardiac asthma, the primary disease will be important. Bronchial asthma is usually met with in emphysema and bronchitis with expiratory dyspnea; the cardiac asthma, on the other hand, chiefly in arteriosclerosis and in all affections which lead to lesions of the left ventricle. In cardiac asthma, spasm, *i.e.*, low position of the diaphragm is absent, as well as all other manifestations on the part of the respiratory tract, as expiratory wheezing and whistling.

Improvement of the cardiac force will be our first aim in treating cardiac asthma, especially if the pulse is weak, and pulmonary edema imminent. We will try to give relief through wine, coffee, camphor,

ether, hot hand and foot baths, and the application of mustard plasters on the chest. If the blood pressure is high and the patient of plethoric constitution, bleeding will often have an excellent effect. It may again be repeated that morphin in moderate doses of about 0.01 gm. is not at all contraindicated in these conditions of cardiac weakness.

Endocarditis.—Endocarditis, as well as valvular lesions, may lead to dyspnea. In endocarditis the quotient P : R (pulse to respiration) is less than 4.5. If complications on the part of the lung cannot be found, this alteration in the relation of the pulse to the respiratory count has probably to be explained by the toxic action of the etiological agents on the respiratory center.

Valvular Lesions.—Valvular lesions, too, are associated with disorders of the respiratory organs. In the lesser compensatory disturbances we find, in adults as well as in children, shortness of breath, at first only on physical exertion as ascending steps. This dyspnea continues for some time after the physical exertion if the disturbance of compensation increases, and in higher degrees may persist even during complete rest. Occasionally one sees attacks of angina pectoris, even in children.

Congenital heart lesions are likewise characterized by shortness of breath on exertion, but may, otherwise, give no discomfort. Dilatation and hypertrophy of the heart and congenital smallness and weakness of the left heart with great development of the right one is found sometimes even in infancy. The prognosis of these conditions, which lead to very pronounced dyspnea, is usually unfavorable. The children are pale, weak, and without appetite; the pulse, however, may be quite good. The cardiac sounds are pure but somewhat soft (Heubner).

If the heart is in a state of a slight compensatory disturbance one will institute absolute rest, or permit moderate movement according to the case. One should not go too far, however, with restriction of the bodily movements. H. Winternitz reports an increase of the pulmonary gaseous interchange and the stimulation to deep inspirations from carbon dioxid baths. To this effect of carbon dioxid baths Nauheim owes its fame as a watering place for cardiac patients. In higher degrees of compensatory disturbances, the cardiac stimulants, chiefly digitalis, are indicated.

Pericarditis.—Pericarditis very readily leads to severe degrees of dyspnea, even if the quantity of exudate is small. For we have to deal not only with a mechanical hindrance to respiration, but the cardiac muscle itself participates in the inflammation of its serous layer. One will try to relieve the discomfort of acute pericarditis by means of an ice-bag, cardiac tonics, as digitalis and strophan-

thus, and, on increased dyspnea, morphin. If the exudate is abundant, so that diastole is hindered, puncture of the pericardium has to be performed, as first recommended by Schuh and Skoda. One goes in through the fourth or fifth intercostal space, near the sternum, 23 mm. deep, avoiding the internal mammary artery. It has been proposed to introduce a fine hollow needle before the larger needle for puncture is introduced, and to observe if the needle moves. If it is immobile, one may conclude that it has not penetrated the heart muscle. Curschmann advises to perform the puncture more laterally and not to hesitate to produce a lesion of the pleura.

Adherent Pericardium.—Pericardial adhesions are associated with severe dyspnea. In recent times Brauer has recommended to resect the parts of the costal cartilages and the sternum which lie immediately over the heart, facilitating in this way the work of the heart during systole; the heart then has only to retract the soft parts and must not overcome the elasticity of the thoracic cage (cardiolysis). In the last years it has been tried to loosen the connective tissue of the adhesions by injections of thiosinamin (fibrolysin). Two or three parts to the whole of a Pravaz syringe of a 15 per cent. solution are injected.

Hydropericardium.—Hydropericardium shows still more intense dyspnea than pericarditis. For cardiac weakness is the chief cause of its origin, and at the same time hydrothorax and ascites will hinder respiration. In these cases, too, one will try to relieve the discomfort by morphin, heart stimulants, or even pericardial puncture.

Arteriosclerosis.—Arteriosclerosis very frequently causes attacks of cardiac asthma, and if a secondary aortic aneurysm develops, severe hindrance of respiration is brought about by pressure on the trachea, by diminution of the thoracic cavity, by pressure on the diaphragm, or by injury of the nerves.

Air Embolism.—The severe danger of air embolism in surgery when a vein of the thorax is opened and air is sucked in on inspiration is well known. The air streams in with a hissing sound and the patient struggles with intense dyspnea, the right ventricle being unable to express the mixture of air and blood producing in this way a bloodless condition in the pulmonary circulation.

Caisson Disease.—Similar to the clinical picture of air embolism is that of the caisson disease which has been thoroughly studied by Heller, Mager, and H. v. Schrötter. The disorder, consisting chiefly in the sensation of severe dyspnea and oppression and in other nervous manifestations, may best be removed by placing the patient again under increased pressure (recompression) and by furnishing him an abundant quantity of oxygen. As a prophylactic measure it is recommended to allow workmen who labor under a pressure of two to three atmospheres to leave the caisson slowly, so that they become ac-

customed to the atmospheric air under a gradual decrease of pressure. The prognosis of caisson disease is usually favorable.

Intravenous Infusion of Oxygen after Gärtner.—Of interest are the observations of Gärtner on dogs, that entirely pure oxygen, free from nitrogen, may be slowly infused into a vein without danger. The oxygen becomes entirely absorbed and no air embolism develops. Naturally it is understood that the infusion is made slowly enough to render reabsorption of the total quantity of gas possible. Experiments on human beings do not exist as far as we know. The first condition, of course, would be that the oxygen used be chemically pure, since any admixture of nitrogen would render the danger of air embolism imminent.

Bronchial Asthma—By bronchial asthma we understand, in accord with Fr. A. Hoffmann, a neurosis of the respiratory nerves, consisting of attacks of dyspnea, associated with a peculiar secretion and with emphysema. Perhaps there are pathological changes in the respiratory center in the medulla oblongata. The pulse is hard and of high tension during the attack which may be caused by irritation from the oversaturation of carbon dioxid in the blood, whereas in cardiac asthma it is constantly soft. The most varied, mysterious factors may evoke an attack of asthma. There are people who get an attack of asthma in certain places and not in others, and it is not at all necessary that the air is better in the one place than in the other. Country people may become free from asthma if they live in the town. Occasionally the influence of weather is undeniable. Some persons remain entirely free from attacks if they are on the sea, or in the mountains. Sometimes the odor of fresh hay, or the smell of a horse stable acts as provoking agent. In some cases the attack is undoubtedly connected with some disorder of the digestive tract. Mayer and Pribram have found that insufflation of the stomach increases the blood pressure, a factor which may play some part in the origin of the attack. In some of these cases we have perhaps to deal with cardiac asthma, the meteorism increasing any existing cardiac weakness by hindering respiration, and producing in this way the asthmatic attack.

Malaria may sometimes lead to attacks of asthma, and at regular intervals corresponding to the febrile attacks, attacks of dyspnea may appear. Heinemann reports a form of acute malaria with severe dyspnea and fever, which betrayed its true nature by its prompt response to quinin.

Intestinal parasites are supposed to cause asthmatic attacks reflexly; in other cases the reflex originates in the genital tract, from the uterus, especially during pregnancy, and at the time of menstruation. Attacks of asthma are farther found in nasal polyps, in hyper-

trophy of the anterior part of the inferior turbinate, in diseases of the tonsils, of the pharynx, of the larynx and bronchi, and finally without any visible cause, "idiopathic asthma."

Hay asthma is caused by the irritation of the pollen of different Gramina, and may lead to single attacks, or to a continual disease, the summer catarrh, at the time of the flowering of grasses.

Asthmatic attacks usually occur suddenly at night; the patient goes to bed feeling entirely well, to awaken after a few hours with the sensation of intense dyspnea and severe cyanosis; the respiration is prolonged chiefly on expiration. The margins of the lung overlap heart and liver; dry râles are to be heard during expiration, and after some time a very tenacious, later foamy sputum appears, and then the attack passes. On longer persistence of the attacks, emphysema usually develops. Not rarely such an accumulation of attacks develops that a severe condition, similar to the status epilepticus in epilepsy, arises.

The appearance of sudden dyspnea with loss of consciousness and spasms in the course of a tabes dorsalis is called ictus laryngeus (Charcot). The patient collapses, sometimes has convulsions, which characterize the attack as an epileptiform one, but usually recovers again very soon.

Sometimes, even in the beginning of asthmatic attacks, an abundant secretion may be found (asthma humidum). In other cases larval asthmatic forms are met with, transient bronchitic manifestations, with abundant secretions, but without any severe degree of dyspnea. Thus in children we find sometimes sudden attacks of fever, with the physical findings of a severe bronchitis which passes again after a few hours. Such conditions may perhaps be explained as asthma in larval form; also in old people such attacks may occur. The fact that this condition improves on administration of sodium iodid seems to make its relation to asthma more probable.

Asthmatic patients show a pronounced emphysematous habitus in earliest childhood; the true substantial emphysema, however, develops only after the long existence of a chronic bronchitis.

The asthma spirals may be mentioned here. These are gray-white, slightly transparent threads, which present, under the microscope, a spiral configuration, with or without a central thread. They are, however, not more pathognomonic for asthma than Charcot-Leyden's crystals and the eosinophilia in the sputum and blood.

Tonic Spasm of the Diaphragm.—In the diagnosis of asthmatic attacks we have, especially in childhood, to exclude other diseases which lead suddenly to bronchostenosis, as croup and foreign bodies. In adults only cardiac asthma and the tonic spasm of the diaphragm have to be differentiated. The latter condition may be easily distin-

guished from bronchial asthma, as v. Leube states, by the fact that the inspiration is spastic with participation of all inspiratory auxiliary muscles, that the thorax remains in the position of maximal inspiration for several seconds, and afterward regains its expiratory position with a certain force.

The heart is pushed downward and the epigastrium protrudes. In bronchial asthma, on the other hand, the inspiration is entirely free, and the hindrance to expiration predominates over all symptoms.

If we suspect a reflex origin of asthma we shall aim to remove the primary cause. In the nasal form we will treat the nose, and eventually try to check an attack through cocainization of the "asthma points" on the anterior part of the inferior turbinate. The administration of sodium iodid, eventually also of arsenic, is advisable. G. See has recommended pyridin, putting 4 to 5 gm. in a cup for inhalation for twenty minutes, three times a day. Other authors, as Fr. A. Hoffmann, have obtained no remarkable effects from this medication. The influence of climate has already been discussed in the etiology of asthma. It is impossible to state in advance which climate will have a beneficial effect on the patient; one must first try one in which the patient can live free from attacks for a long period. Of the narcotics which mitigate the violence of the attack, morphin, cannabis indica, chloral hydrate, and stramonium cigarettes may be mentioned. Trousseau reports an interesting case. A ship's captain, suffering from asthma, remained free from attacks when his ship was loaded with guano: the odor of ammonia was sufficient to prevent the reappearance of the attacks. Vapors of niter paper and hot hand and foot baths sometimes give relief. Graves prescribes the following mixture to be taken in one dose during an attack:

Rp.	Tincturæ hyoscyami,	2.0
	Acetii scillæ,	2.0
	Vini ipecac,	2.0
	Camphoræ,	0.2
	Vini,	10.0
	Aquæ,	20.0

Digalen Cloetta, in intravenous injection (1 c.c.), is said to be of very rapid effect, sometimes directly checking an attack. Of all medicaments sodium iodid seems to deserve the most confidence, 1 to 2 gm. *pro die* in solution.

Diseases of the Blood.—Any diminution of the blood coloring matter in diseases of the blood brings about a compensatory acceleration and deepening of respiration. Yet blood diseases may indirectly produce dyspnea from affection of the heart. The pressure of the glandular tumors in lymphatic leukemia may produce severe

attacks of dyspnea. Perhaps the "inability of the blood to breathe," on which Virchow laid stress, plays also a great part. In the myeloid form of leukemia, the enlarged spleen and high position of the diaphragm may unfavorably influence respiration. Chlorotic girls suffer from air-hunger and oppression almost constantly on muscular exertion, but even without this the respiration is accelerated in severe cases; the diaphragm usually stands high, so that the respiration is not only fast, but at the same time superficial. In nervous, bloodless girls there exists also the tendency to hysterical tachypneic attacks in which the respiration is similar to that in an animal hunted to exhaustion; in a ward in which a patient shows this type of respiration other patients with the right disposition to "psychical infection" may afterward show similar attacks (v. Noorden). The bad quality of the blood and the cardiac weakness resulting from it are probably the causes of the dyspneic condition in Addison's disease.

Diseases of the Kidneys.—Patients with kidney diseases complain very frequently of shortness of breath. The explanation of this symptom is not the same in all cases. In one case we have to deal with bronchial asthma, the respiratory frequency thereby being decreased, the expiration prolonged and accompanied by wheezing sounds. In other cases there exists cardiac asthma, for which, according to Senator, arteriosclerotic changes are responsible. The tendency to bronchial catarrh which nephritic patients frequently show sometimes plays a part, at other times pulmonary edema of slight degree. During the uremic attack, severe disorders of respiration are frequently observed. The respiration is stertorous and is often of the Cheyne-Stokes type.

The treatment of nephritic dyspnea depends on its different causes. In the asthmatic form, sodium iodid will be used, and all the other measures which are recommended in bronchial asthma. If we have to deal with insufficiency of the cardiac muscle, as in the advanced stages of contracted kidney, we will try to improve the cardiac force through digitalis and strophanthus; the dyspnea of the uremic attack does not demand any special treatment beside those therapeutical measures which are indicated for the uremia itself. An excellent remedy in nephritic dyspnea is diuretin, in very small doses, 0.05 to 0.1 gm. two to three times a day, not in diuretic quantities, a treatment which was often mentioned by Nothnagel in his lectures.

Gout.—Gout may lead to disorders of respiration. There exists a gouty affection of the larynx which sometimes leads to very obstinate hoarseness, but scarcely ever to severe attacks of dyspnea. The gouty diathesis is very often associated with the disposition to hay asthma; and this latter condition is frequently found in those regions where the uric acid diathesis occurs commonly. Asthmatic attacks are

altogether not rare in gouty patients. v. Noorden, however, disputes the assertion of others that the uric acid contained in the blood may lead to irritation of the respiratory center. In many cases we have simply to deal with a chronic bronchitis with a tenacious, or more frequently an abundant, secretion (pituitous catarrh). Uric acid, found in the sputum several times in such cases, furnishes no proof that the uric acid contained in the blood is connected with this condition.

The immediate cause of the dyspnea will furnish the indications for our therapeutic action. We will try to improve the catarrh or to check the asthmatic attacks; besides we will try to meet all those demands which the primary disease will require.

Diabetes.—Also in diabetic patients dyspnea is observed. The typical diabetic coma, as Kussmaul has already mentioned, is characterized by a great, deep, accelerated respiration, in which no obstacle to respiration is present. The contrast between the absence of all cyanosis on the one side and the loud deep respiration on the other is characteristic of certain forms of diabetic coma. In forty-four fatal cases of diabetic coma, Naunyn has observed twelve with this typical dyspneic picture. In many cases this peculiar dyspnea is the first symptom of the approaching coma; the patient feels weak, complains of headache, and shows the respiration just described. Then other symptoms follow: stupor appears, the pulse becomes small and fast, and the temperature sinks. There are other asthmatic attacks in the course of diabetes which are casually connected with arteriosclerosis; thus Naunyn points out that true cardiac asthma and angina pectoris may be observed in the course of a diabetes, even in those cases where the sugar excretion has never reached a high degree and can, therefore, not be made responsible for this condition. Nevertheless, Naunyn has observed that all dietetic errors which increase glycosuria react unfavorably on these conditions. The dyspneic respiration in diabetic coma is, as is commonly known, related to the acidosis, thus to acid intoxication, and this acid is supposed to be formed in a faulty intermediary metabolism. Above all, it is the β-oxybutyric acid to which the acid coma and the deep respiration are due. Experimental facts agree quite well with this conception, and in this way one has become used to connect great respiration with acid intoxication. Now it has been found that infants suffering from severe gastrointestinal disorders show this peculiar type of respiration, and therefore, also in these cases, the presence of acidosis has been supposed, above all by Czerny and his school in Breslau. This doctrine of acid intoxication in severe gastroenteritis is still too young to be discussed here more in detail.

The treatment of dyspnea due to acidosis in the course of diabetic coma coincides with the general dietetic measures against the metabolic disorder.

Cholemia.—Less pronounced, usually, is the dyspnea in cholemia. In this condition the effect of the bile acids is perhaps complicated and obscured by the action of other poisons.

Nervous Diseases.—Severe disorders of respiration are further found in organic, as well as in functional nervous diseases. In cerebrospinal meningitis the respiration is commonly accelerated, whereas, in the tubercular form, long respirations alternate with superficial ones, which follow each other with increasingly shorter intervals, until toward the end a periodically intermittent respiration develops, eventually of the Cheyne-Stokes type. Chronic hydrocephalus usually shows a normal respiration. In epilepsy, in the eclampsia of pregnancy, in infantile eclampsia, and in tetanus a severe hindrance of respiration, with intense cyanosis, appears in the course of the unconscious state. In this condition we may have to deal with spasm of the closers of the vocal cords, which take part in the tonic cramp of the entire musculature of the skeleton, or with a spasm of the diaphragm as indicated by its deep position. However, usually there is no time to figure out the inferior border of the lung, and this also is not at all essential since spasm of the diaphragm manifests itself in an undoubted way through a marked, immovable protrusion of the epigastrium.

If in this condition we have to deal with laryngospasm, intubation may be tried, but in all cases artificial respiration should be instituted as soon as possible. In some cases of eclampsia infantum, even artificial respiration is useless, and the little patient dies of cardiac paralysis. Sometimes one succeeds in checking the spasms through chloroform inhalations, but if inspiratory movements are absent the application of the chloroform mask has to be combined with artificial respiration. The reappearance of spasms, if threatening, may be prevented by chloral hydrate, given internally to adults in doses of 3 gm., or as an enema of 5 gm.; for children one prescribes 1 gm. chloral hydrate to 10 gm. acacia gum and 50 c.c. water, and gives one-half of this quantity for one enema. The danger to life threatened by the spasm is averted, and only later is life endangered through the aspiration of matter during the attack, which may result in pneumonia.

In Graves' disease, disorders of respiration are manifold. They may occur in the form of continual dyspnea or in attacks, with prolongation of both respiratory phases, with superficial and irregular breathing.

Sometimes patients complain of nocturnal attacks of suffocation.

These are usually of cardiac origin, and not due to compression by the goiter, which is commonly of moderate size. Bryson has called attention to the lessened inspiratory expansion of the thorax, showing, on maximal inspiration, only a few centimeters' difference from the expiratory measurement. The respiratory frequency is usually increased at the same time. This insufficient expansion of the thorax has been reported by some authors in patients with other forms of goiter; Moebius, however, does not attribute any great importance to this symptom, which is probably caused by general muscular weakness.

Disorders of respiration are found, further, in hysteria; attacks of tachypnea, as well as peculiar laryngospastic seizures, in which laryngoscopic examination shows the rima glottidis entirely or partially closed; the dyspnea is entirely inspiratory, its frequency is decreased. On paresis of the openers of the vocal cords, the expiration is ringing. Not seldom these conditions are so obstinate that tracheotomy has had to be performed. In other cases the dread of the operation or the impression made by the preparation for it will be sufficient to bring relief. A strong faradic current may sometimes have an effect which impresses the laity as miraculous. The electrodes may be applied under the angles of both jaws or at the height of the thyroid cartilage. This method of electric treatment also is indicated in spasm of the diaphragm, since both phrenic nerves are reached by it. Some authors report good results from the use of the galvanic stream. A respiration chair is advocated by others. The inhalation of oxygen is of no effect in nervous tachypnea.

Asphyxia of the New-born.—Asphyxia of the new-born deserves special attention. It is caused by severe disturbances in the placental circulation during birth, as from premature detachment of the placenta or from pressure on the umbilical cord. Premature respiratory movements are brought about in which the amniotic fluid, mucus, and meconium are aspirated. Thus one of the most important signs of intrauterine asphyxia is the passage of meconium. These substances enter the aerial passages, producing a hindrance to respiration when the children are born. Runge distinguishes two grades of asphyxia: in the light grade, the cardiac action is retarded through stimulation of the vagus nerve, the muscle tone is retained, the respiratory movements have usually not ceased entirely, but are only insufficient and may be incited through stimulation of the skin. In the severe asphyxia the waxy, pale color of the child is very obvious; the muscles have lost their tone, and cutaneous irritation is of no effect.

Artificial Respiration.—The treatment of asphyxia depends on the degree. In the slight forms, cutaneous stimulation should be tried; the skin should be vigorously rubbed, the child placed in a warm

bath, and sprinkled with cold water; eventually the mucus may be aspirated from the windpipe through a catheter. This has to be done in all cases of severe asphyxia, and followed immediately by artificial respiration. Various methods have been advocated. Silvester recommends quick upward movements of the arms of the child and, with their return, compression of the thorax, which stimulates inspiratory, as well as expiratory movements. Marshall Hall tries to start respiratory movements by changing the position of the child, laying it on its stomach, then on the right and left sides. Scholler elevates and lowers the costal cage directly; most frequently used, however, are Schultze's swinging movements (Schultze, "The Apparent Death of the New-born"): After ligature of the umbilical cord the child is held by both shoulders so that the thumb of the physician is placed on the anterior wall of the thorax, the index-finger, in the axilla from behind, and the other three fingers along the posterior wall of the thorax. The sinking head finds in this way a ready support between the ulnar margins of both palms. The physician standing with his legs apart and his trunk bent somewhat forward, swings the child upward, holding it in this way, with his arms constantly stretched. When his arms are somewhat above the horizontal he stops so smoothly that the body of the child sinks slowly forward, compressing its abdomen heavily by the weight of its pelvic end (by no means must the body of the child be slung forward). At this moment the whole weight of the child rests on the thumbs of the physician which lie on the child's thorax. It must be carefully observed that the thorax is not compressed by the grasp with which the child is held. Its body rests first exclusively on the two index-fingers of the obstetrician placed in the floor of the axilla. Neither lateral compression of the thorax should be exerted by the palms which have to support the head, nor should the thumbs press the thorax in front. The bending of the vertebral column during the swinging must be brought about exclusively in its lumbar part and not in its thoracic part. The thumbs have to hold the thorax without exerting pressure, being the only support on which the slowly sinking body of the child rests. The elevation to the horizontal position is brought about by a graceful swinging of the arms in the shoulder articulation, the movement of the arms becomes then gradually slowed, and by carefully measured movements in the elbow-joints, and of the scapulæ on the trunk, the obstetrician regulates the gradual sinking of the inferior part of the trunk of the child. Through this gradual sinking forward of the infantile pelvis over its abdomen there results a considerable compression of the thoracic organs, through the diaphragm as well as through the entire chest wall.

After the child has been brought down slowly, sinking forward,

the obstetrician moves his arms upward again between his legs. In this way the body of the child becomes stretched with a certain swing. The thorax, free from any pressure (the thumbs of the obstetrician now lying loose on the chest wall) becomes dilated through its elasticity, and the weight of the child, whose upper extremities hang on the index-fingers of the obstetrician, the sternal ends of the ribs being fixed, brings about a considerable elevation of the ribs. The diaphragm, too, sinks downward through the swing transmitted to the contents of the abdominal cavity. In this way a deep inspiration is produced entirely passively. After a pause of a few seconds the child is swung up into the previous position, and, pressing with its whole weight on the thumbs lying on its anterior chest wall, it slowly bends over and produces, in this way, a new expiration mechanically.

The performance of this method demands some practice, since it must be done with the necessary energy, but, on the other hand, not too roughly. At any rate the appearance of hematomata cannot be accounted for by this procedure, as Reller emphasizes. For these hemorrhages of the abdominal organs are found as well in fatal asphyxia, due to the overfilling with blood in these organs, as Rokitansky has already reported.

Acquired Asphyxia of the New-born.—Besides the congenital, we distinguish an acquired form of asphyxia which is characterized by the fact that within a few hours or days after birth the respiration becomes feebler. The children slumber continually, have no desire to nurse, become cooler and cooler to the touch, and gradually fall away. This may be observed in various conditions of weakness, as in premature birth, in debility, or in inherited syphilitic children.

Atelectasis of the Lungs.—Atelectasis of the lungs may be combated by frequently repeated baths of 35° C., with cold douches on the neck, back, and chest. One will guard against collapse by economy of heat (incubator); for these children mother's milk is essential; if they fail to nurse, it must be pumped out and given in quantities of 30 to 50 gm. every two hours.

Atelectasis of the new-born is found further when injuries of the brain (hydrocephalus, hemorrhage *intra partum*) have lowered the irritability of the respiratory center. Also, in later life, atelectasis of the lungs may develop in individuals of any age if they are feeble or weakened by severe diseases, as typhoid fever, measles, and scarlet fever. Predisposed to it are rachitic individuals and those with curvature of the spine. One will combat this condit on in adults by the cool baths already mentioned and by compelling the patient to breathe deeply and by frequent change of position. Some tendency to atelectasis is found almost always in bed-ridden patients; if one has them sit up in order to auscult the dependent portions of

the thorax one can hear, on the first respiration, atelectatic crepitations which cannot be heard later on.

Even in robust infants, who have lain quietly for some time without crying, this phenomenon may be heard on the first deep inspiration, disappearing, however, at once on loud crying.

Intoxications.—*Chloroform Anesthesia.*—Asphyxia is frequent, following chloroform anesthesia. A reflex occlusion of the glottis and an expiratory position of the thorax may be brought about in the beginning of the narcosis. This does not amount to much and usually passes spontaneously as soon as the progressing narcosis relaxes the spasm. In the state of excitation, on the other hand, asphyxia may be produced, in this way, that the tongue is pressed against the posterior wall of the pharynx, and thus the epiglottis closes the aditus ad laryngem. The blood-red discoloration of the face calls attention to this symptom, and it becomes necessary to loosen the under jaw at once through the manipulation of Heilberg and to bring the tongue forward. If spasms of the mouth exist, the mouth must be opened by force. During deep narcosis occlusion of the aditus ad laryngem may be brought about by the passive falling back of the tongue. In this case it is sufficient to put a pillow under the thorax and to bend the head more strongly backward, whereby the point of support of the tongue is removed from the aditus ad laryngem to the palatine arch. The respiratory center, as well as the peripheral fibers of the vagus nerve in the lung, may become paralyzed, a complication which must be combated by means of artificial respiration, stimulation of the phrenic nerve, and massage of the heart. In recent times injections of adrenalin have been recommended as a means of reanimation.

Other poisons as well may kill through paralysis of the respiratory center. The paralysis may result directly or be preceded by a stage of irritation. Faradization of the phrenic nerve on the neck, artificial respiration, rhythmical traction on the tongue (Laborde), and inhalation of oxygen are our means of combating this condition.

Curare.—Poisons may hinder respiration in still other ways. Curare causes paralysis of the motor nerve endings, leading in this way to severe asphyxia which may be successfully combated by artificial respiration.

Carbon Monoxid; Hydrocyanic Acid.—Carbon monoxid and hydrocyanic acid change the hemoglobin of the blood to carbon monoxid and cyan-hemoglobin, respectively. The deleterious action of these substances is not due to the transformation of the total hemoglobin into these compounds, which render it worthless for respiration, but rather to a toxic effect on the vital nerve centers.

Suffocation by Carbon Dioxid Gas.—In poorly ventilated rooms an

exceedingly large amount of carbon dioxid gas is present together with an impoverishment of the air in oxygen. This disproportion is frequently found in cellars in which fermenting wines are stored; here the development of the carbon dioxid is explained by the fermentative process. A content of 9 per cent. carbon dioxid in the air may be considered not dangerous. To be compatible with life, the tension of the carbon dioxid in the air must be inferior to that of the blood, since otherwise the carbon dioxid could not be given up by the blood into the atmosphere. If a large amount of carbon dioxid is present in the air, the excretion of CO_2 is greatly reduced, whereas its excretion is normal only where we have to deal with oxygen too little disposable. An example of a deficiency in oxygen together with good decarbonization is the asphyxia which attacks aeronauts at a height of 8000 meters.

One per cent. of carbon dioxid in a room filled with human beings is a sign of very bad ventilation. Though the carbon dioxid content in the air is not dangerous itself, other substances given up into the air through perspiration may be the cause of indisposition. True carbon dioxid intoxication, caused by an accumulation of people in a closed room, will scarcely be observed under normal conditions. Clinical differences, too, may be observed between restriction of oxygen and a too high content of CO_2. The first leads to severe symptoms of irritation (spasms), which are usually absent in CO_2 intoxication. This latter leads to cyanosis, dyspnea, eventually to somnolence and coma. If help is brought in time the prognosis is favorable, since sequelæ are unknown. The severe CO_2 intoxication must be combated with artificial respiration, faradization of the phrenic nerve, eventually tracheotomy, insufflation of oxygen, and blood-letting (300 gm.), followed by salt infusions, and, if signs of cardiac weakness predominate, with injections of camphor.

Claude-Bernard's observation that one may become used to bad air is of importance. He placed a bird under a bell-jar, and observed how it behaved on gradual deterioration of the air. If, at a time when the bird still lived, he placed under it another which had not become used to the bad, air, the latter died at once. The same signs of suffocation which we observe in too thin oxygen, as in high mountains, may occur in compressed oxygen. The respiration together with the heart action becomes deep, irregular, and accelerated. Drowning, too, is chiefly death from suffocation.

Transfusion of Heterogenous Blood.—At the time when transfusions with lamb blood played a great rôle in therapy, attacks of dyspnea were frequently observed during the transfusion of the heterogeneous blood. Denis, in 1667, had already performed such an experiment connecting the carotid artery of a sheep with the jugular vein of the

patient, thereby observing severe attacks of suffocation. These attacks may be due to an overfilling of blood in the superior vena cava. However, these disturbances may be explained in another way: the heterogeneous blood-corpuscles on disintegration stick together and in this way give rise to the formation of small emboli (Landois).

CHAPTER IV

PAIN IN THE CHEST

GENERAL REMARKS

Pain in the region of the thorax is one of the commonest complaints for which patients ask medical help. Only a small percentage of these cases is due to disease changes in the vital organs themselves, since many severe affections of the thoracic viscera may run their course without pain, and insignificant processes of the thoracic walls often cause very painful conditions. An example may serve to illustrate these facts. Widespread cavity formation in the lungs may develop almost without symptoms, while the occurrence of a herpes zoster may cause the most violent pain.

The intensity of the pain, therefore, is not conclusive of a dangerous significance. Just on this account an exact examination is necessary in slight maladies pointing to the thoracic organs, and with the high development of the means of diagnosis to which the Röntgen rays have contributed in later times, the nature of the suffering is soon brought to light.

CONSTRAINED POSITION

Severe breast pain is not seldom disclosed by the constrained position always assumed by the patient, and indeed in comatose and very young patients there is no other means at our disposal of inferring the painfulness of a thoracic ailment.

The habit of assuming a lateral position may cause patients always to return to the same, thus giving the impression of a constrained position; we see in heart disorders of all kinds that a lateral position, usually the left, is not endured for any length of time, because a change of position of the heart leads to a dragging of the structures at its base. Finally in stiffness of the neck (for instance, tubercular meningitis) a lateral position is always maintained, to be sure not continually the same.

Even in pain of the pleural cavities the behavior of patients is not constant. Sometimes they lie on the healthy side, if the case is one of great sensitiveness to pressure (peripleuritis); in other cases on the affected side, if the respiratory excursion is especially painful, and they must try to immobilize the affected side as much as possible.

The respiratory need is also a determining factor in the lateral

position. In an exudative pleurisy with an enormous effusion patients will take care to lay themselves on the affected side, which is not very sensitive to pressure, and thus give the freely breathing lung the greatest possible respiratory movement.

We see, therefore, that only with a certain reserve and without pointing to the *locus* of disease, may a symptomatic value be attached to the constrained position in the sense of indicating a painful thoracic disease.

In painful diseases of the back, namely, those sensitive to pressure (tuberculous spondylitis, caries of the ribs, furuncle, etc.) patients take the abdominal position just as in many painful affections of the abdominal organs. Examination for sensitiveness on percussion discloses the extent and retrogression of pneumonic and pleuritic processes. It sometimes enables us to make an early diagnosis of bronchopneumonic foci in the course of a bronchitis, and permits conclusions as to the localization of gangrene of the lungs, abscess and tuberculous processes.

In pneumothorax, diffuse sensitiveness on percussion is found over the whole side and in pericarditis over the heart.

PROGNOSIS OF CHEST PAIN

Pain in the chest may indicate a very dangerous ailment (for instance, aneurysm of the thoracic aorta, angina pectoris). Aside from these, there is danger in the high grade of pain itself. Breathing becomes superficial and the desire to cough is repressed. In this manner, on the one hand, circulatory disturbances arise in the lungs, and on the other, an accumulation of secretion, and both causes may lead after a shorter or longer period of time to bronchopneumonia and death.

Thus patients who suffer from trichinosis often die of bronchopneumonia, and the cause of this fatal complication is to be sought for in the enormous painfulness of the diaphragm and intercostal muscles, which makes free expectoration impossible.

CLASSIFICATION OF CHEST PAIN

According to the seat of the ailment, we distinguish the following groups of chest pain:

1. Heart and pericardium.
2. Vessels.
3. Syncopal chest pains.
4. Pleura and lungs.
5. Mediastinum.
6. Bronchi and trachea.

7. Esophagus.
8. Intrathoracic nerves.
9. Bones, periosteum, and joints.
10. Musculature.
11. Nerves of the thoracic wall.
12. Mammary glands.
13. Skin.

1. Heart and Pericardium

In general in the pathology of the diseases of the heart muscle, endocardium, and valvular apparatus, complaints of pain are not as prominent as in the pericardial diseases.

Diseases of the Valves and of the Cardiac Muscle.—Still Nothnagel (*Zeitsch. f. k Med.*, Bd. XIX, 1891) has brought forward the idea that we should find sensitive disturbances not so rarely in heart disease if we paid careful attention to the matter.

In 483 valvular lesions in his clinic he found the following relations: Pain in aortic insufficiency in 60 per cent., and in aortic stenosis in 40 per cent. in the combination of both lesions, in 68 per cent.

Figures in mitral disease seem to be very small. In mitral insufficiency 7 2/3 per cent. of cases are associated with disturbances of sensation; in mitral stenosis 17 per cent., and in the combination of both lesions 17 per cent.

It is a very remarkable circumstance that aortic and mitral insufficiency combined cause much fewer painful disturbances than aortic insufficiency alone; according to Nothnagel, in only 18 per cent. as opposed to 60 per cent. in aortic insufficiency alone, without the mitral lesion.

It is not supposed that the lesion of the left heart hinders the pain, rather that this peculiar circumstance stands in relation with the etiology.

Pure aortic lesions are in the majority of cases of arteriosclerotic nature, while the combination with mitral lesions are found preponderately in endocarditic processes of long duration at both orifices. v. Neusser made the observation that arteriosclerotic processes lead to severe forms of heart pain, to the coronary angina, earlier than rheumatism.

The pain is usually not paroxysmal if we disregard angina pectoris, but is of longer duration, often continued with remissions and exacerbations. Sometimes it is only a heavy sensation of pressure, often a wave of pain, or a penetrating anguish. It is almost always associated with feelings of anxiety, and patients have a fear of death.

In diseases of the heart muscle, as fatty heart, myodegeneration, and hypertrophy with or without arteriosclerosis, not only stenocardial

attacks, but also the slight and persistent complaints just described, occur frequently. Their symptomatological significance is rather small, for heart neurasthenics often complain of that kind of trouble, and also of sensations of annihilation, and radiation of pain into the left arm which call to mind angina pectoris.

Of greater significance for the diagnosis of organic heart affections without changes in the valves may be, perhaps, Head's zones, which manifest themselves in hyperalgesia on slight pressure of folds of skin pinched up, as well as on slight pin pricks. Nothnagel in the above-mentioned work has called attention to these "eccentric irradiation phenomena." Head found the skin zones of spontaneous pain or hyperalgesia in the supraclavicular and infraclavicular regions as well as in the region of the nipple on the left side.

Cor Mobile.—The pain associated with movable heart is never so intense as that occasionally found in connection with the movable parenchymatous abdominal organs. Alois Pick, on the basis of systematic investigations on change of position of the heart in 1000 persons, comes to the conclusion that "although this condition sometimes causes no pain, it is in the greatest number of cases associated at times with palpitation, faintness, and dizziness on running or on forced movement, as well as with inability to lie on the left side without oppressive sensations." These results agree with those of Rumpf.

Angina Pectoris.—Symptomatology.—That most intense of thoracic pains—angina pectoris (stenocardia)—is one of the most dangerous conditions. With extremest pain, localized in the region of the heart, is associated such an indescribable feeling of annihilation, of immediate oncoming death, as to cause the patient to shudder at the memory of it.

The pain often radiates into the left arm along the course of the ulnar nerve; but radiations occur into both arms, into the neck, the region of the trigeminus, the shoulders, the lower portions of the body the legs, and testicles.

With this classical type of angina pectoris there occur forms scarcely recognizable as such. The pain is often obscured, and there remains only the picture of a severe immediate collapse, which often leads almost at once to fatal syncope. In other cases, especially when the attacks occur at night, the entire situation calls to mind a cardiac asthma, which, indeed, may occur together with true stenocardia. Again, in other cases, a trigeminal neuralgia, a gall-stone or kidney-stone attack, a gastralgia or intestinal colic is simulated, and of the symptom-complex of angina pectoris there remains only the "facies hippocratica," and even this also occurs in the other conditions. Again, the pain alone may rule the picture, and the collapse is insignificant. In any case, pain alone is no measure for the severity of

the attack. Apparently light forms end fatally, labile severe forms may recur for years, and with time decrease in intensity.

The activity of the heart shows a very varied behavior in stenocardial attacks. The highest degree of bradycardia and tachycardia, arrhythmia, even delirium cordis, may occur as well as an entirely normal action. In heart affections the pulse may appear regular and strong at the onset, and a previously existing murmur may have disappeared, so that the diagnosis of a heart lesion is impossible in the beginning. Respiration is always perfectly free, and the patients, in their anxiety, try to repress it, lest the pain be increased through movement. This fact is of value in the differentiation from bronchial asthma.

Blood Pressure.—The behavior of the blood pressure in a stenocardial attack is of special interest for the conception of its pathogenesis, as well as for the therapy. According to v. Neusser the localization of the vessel spasms is of importance for the blood pressure. In the abdominal form of the disease, in *angina abdominis* of Pal, there arises an enormous increase of blood pressure as a result of the constriction of the vessels supplied by the splanchnic nerve.

If the vessel spasm affects only the region of the coronary arteries the blood pressure sinks owing to anemic heart weakness, and an interference of the two factors is to be expected, when there is added to the spasm of the coronary arteries spasm of the vessels of the upper extremities.

Thus it sometimes happens that one sees anginal pain disappear on injury to the heart's power from dilatation, and that treatment with digitalis removes the dilatation and immediately starts up the attacks.

There are, however, cases—v. Neusser describes three—in which the high blood pressure throughout is not influenced by the number and strength of the attacks, as Huchard and Mackenzie thought. Improvement of the coronary angina by treatment with digitalis and by raising the low blood pressure is seen occasionally, especially in those cases which are associated with cardiac asthma.

Primary Diseases of Angina Pectoris.—*Coronary Sclerosis.*—Among the fundamental diseases in which one may find true angina pectoris, arteriosclerosis of the coronary arteries occupies the first place. This may cause a narrowing of the lumen of the vessel in its entire course, or only at its point of exit. By this continued narrowing one may explain trophic disturbances of the heart musculature, but not the paroxysms of pain. In cases where the attacks come on from hard work, one might take the view that the blood supply was only sufficient for the function of the heart muscle in rest and at once failed when higher demands were made on its action. Still an attack

may occur in complete rest, even in sleep, and the view of v. Neusser accords much better with the facts, that we have here to deal with a spasmodically occurring cramp of the vessels. A similar process is observed in arteriosclerotic conditions, as in the intermittent limping of Erb. Through this conception another phenomenon is made more comprehensible, *i.e.*, the improvement of angina pectoris by increasing arteriosclerosis, as in old age. Then the vessel walls become too rigid to allow of vasoconstrictor attacks. In place of the paroxysm, the longstanding muscular insufficiency takes place. Other diseases of the vessels may lead to this symptom-complex.

Endocarditis.—Like the atheromatous narrowing of the coronary vessels at their origin, an aortic endocarditis may bar their lumen by thick deposits. Thus v. Neusser explains the great rarity of angina pectoris in rheumatic aortic insufficiency, which, as is well known, does not go so far in its changes, as well as the far greater rarity of the combination of mitral lesions with stenocardia. Still in some mitral stenoses the aortic system and also the territory of the coronary vessels do not fill well.

Coronary angina in fatty heart has scarcely any connection with the fat infiltration of the heart muscle. Corpulent persons suffer from arteriosclerosis in many cases, and the occurrence of coronary angina may be explained in this way.

Pericardial Synechia (*Adherent Pericardium*).—Pericardial synechia may cause true angina pectoris, by destruction of the lumina of the coronary vessels.

v. Neusser made an interesting observation that rheumatic pericarditis resulting in the concretio pericardii cum corde, leads to stenocardial attacks, generally not very dangerous, oftener than tuberculous pericarditis.

Syphilis of the Heart.—While heart syphilis may run a rather symptomless course, syphilitic endocarditis, whether it has attacked the aorta at the point of departure of the coronary vessels or in their farther course, leads often not only to attacks of cardiac asthma, but to real angina. An early energetic antisyphilitic therapy may help at times, but only too seldom, and assures the diagnosis *ex juvantibus;* changes far advanced permit a *restitutio ad integrum* just as little as in syphilitic changes of the vessels in the brain.

Stenocardia may result even in the secondary stage of syphilis, but the changes usually develop only after years. Krehl doubts in this case that we have to do with true angina and considers the attacks in the secondary period rather as nervous troubles. Post-mortem examinations have not yet been made of the vessel changes alleged to have developed so early.

Tobacco.—It is very important to remember the stenocardia

resulting from abuse of tobacco. Leube relates that in a patient who discontinued this abuse he saw the attacks of angina, previously very frequent, cease at once. From the ambiguity of the symptoms which the tobacco heart makes, when there is a suspicion of this condition a careful examination must be made of the mouth, and a central scotoma in the visual field serves as a helpful means of diagnosis.

Lead.—Lead poisoning must be mentioned, as it leads to vessel changes, and in this way also to stenocardial attacks. Lead colic must be differentiated since it often resembles the angina abdominis. Still the sensations of annihilation are absent in the colic, and the obstinate constipation and boat-shaped contraction of the body are not present in angina.

Autointoxication and Nervous Affections.—Autointoxication of the stomach and intestine (Potain and Huchard) as well as neurasthenic and hysterical conditions whose significance is not clear, may result in attacks of angina.

Angina Pectoris Vasomotoria of Nothnagel.—To these cases also belongs the angina pectoris vasomotoria described by Nothnagel. By this he understands attacks greatly resembling the true angina pectoris, which do not originate in a primary heart lesion, but in a widespread arterial spasm with secondary symptoms of stenocardia. These patients have peculiar localized paresthesias, especially in the hands and feet; sensations of numbness and cold with precordial distress, palpitation, dull pains in the region of the heart, which occasionally radiate into the left arm.

The objective examination shows strengthening and usually slowing of the heart action; it always remains regular throughout. The extremities are pale and cold, sometimes cyanotic.

Nothnagel describes exhaustively the relation of the neuroses to stenocardia. The spasms of the vessels in the periphery stand in causal relation to the heart symptoms. If the angiospasm is prevented by warming and rubbing the feet the heart symptoms do not occur. The discomfort in these cases is improved by walking about, which is not the case in true angina. Palpitation is the reaction of the heart, otherwise entirely competent, against the sudden rise of blood pressure caused by the general spasm of the vessels. (Nothnagel, "Deutsches Archiv. f. kl. Med.," Bd. III).

Whether the autotoxic angina pectoris belongs to this harmless disease picture and to what extent, is not clear.

Tabes Dorsalis.—Crises in the cardiac region of the vagus nerve are, according to v. Leyden, the cause of stenocardiform attacks in the course of a tabes dorsalis. Pain, extending into the left arm, feelings of annihilation, facies hippocratica, and heart weakness cause the picture to resemble completely that of organic angina

pectoris. The gastric crises also may bear a great resemblance to the heart crises, and in this way to stenocardia.

There remains still to be described the symptom-complex in metabolism diseases.

Diabetes Mellitus.—Schmitz and later v. Leyden have called attention to the presence of cardiac symptoms in diabetes mellitus. These are dependent on the arteriosclerosis existing in the coronary arteries. Naunyn disregards their relation to glycosuria, since the arteriosclerotic diabetics usually have only a moderate glycosuria. When we succeed in removing the sugar from the urine we may sometimes observe a favorable influence on the heart ailment, but at other times not.

Gout.—Gout may lead to typical attacks of angina pectoris, often in company with cardiac asthma (Minkowski). Attacks occur of autotoxic or of purely nervous origin which do not result, like the former, from sclerosis of the coronary vessels (Huchard); also vasomotor anginas, as Nothnagel has called them, in connection with which, however, we must not forget that the dangerous true angina pectoris may accompany the frequently neurasthenic gouty diseases with vasomotor disturbances, and may in this way simulate the harmless picture (Minkowski). The behavior in the attack itself explains nothing. The whole disease picture and the causes of the attacks must be considered. In any case, with negative findings in the vascular system the diagnosis of vasomotor neurosis must be made with great caution.

Treatment of Angina Pectoris and of the Cardiac Pain of Aortic Incompetency.—In discussing the treatment of these ailments we shall give the nervous forms special consideration. If we have finally convinced ourselves that an organic heart lesion is not present, we must endeavor to reassure the patient. He should not live like a person suffering from heart trouble, but gradually gain confidence in the power of his heart. Existing intestinal atony, constipation, or anemia should be relieved, and his general condition improved by residence in the country, the cold-water treatment and "Oertel's terrain kur."

Hasebrock has seen excellent results in these cases from thoracic massage and medical gymnastics, and considers the mechanotherapy especially indicated when sensitiveness to pressure exists in the region of the apex and axilla; this speaks strongly for the neurotic nature of the trouble.

In true coronary angina, all strain on the heart from physical or mental work must be strictly avoided, as well as that from rich food, constipation, and meteorism.

Continual treatment with theobromin, beginning with doses of

3 gm. pro die, later increasing to 2.0 to 2.5 gm., is indicated in guarding against the attacks (Robert Breuer).

This medication has shown itself very efficacious in the abdominal forms associated with increased blood pressure, in which a combination of diuretin with sodium iodid has also been of value (Pal).

Rhodan salts in doses as high as 3.0 gm. pro die may be tried.

In attacks of pseudostenocardia this medication is worthless.

The attack itself is to be treated differently, according to the presence or absence of heart weakness. With heart weakness, camphor, ether, wine, as well as bathing of the hands and feet in hot water, and the application of mustard plasters over the heart are to be tried.

With high blood pressure we not only must guard against digitalis but also against morphin, which does not decrease the tension of the vessels (Pal).

In this type of cases the inhalation of 5 drops of amyl nitrite, or of nitroglycerin tablets up to 0.5 or 1 mg. (1 to 3 tablets, pro die), as recommended by Nothnagel, is effective; Dujardin-Beaumetz recommends nitroglycerin, 3 drops to a Pravaz syringe, in subcutaneous injections.

Ortner, in Neusser's clinic has observed good results by using the erythrol tetranitrate. He considers 0.05 gm. as the highest daily dose, and 0.01 to 0.02 gm. appropriate for single doses.

He prescribes:

Rp. Erythrol tetranitrat, 0.1–0.2
Extr. et pulv. Gentian q.s.
M. f. l. a. pilil. Nr. XX.
Consperge pulv. cort. cinnamon.
S. Three of the weaker pills daily between attacks; two of the more powerful pills in case of attack.

Arteriosclerosis of the aorta without involvement of the coronary arteries, or aneurysmal dilatation may, according to the view of some authors, cause stenocardiform pain. v. Schrötter believes that the affection must have spread to the adventitia before there is pain. It must be accepted that the sensitiveness of the vessel wall is variable in different persons, as the tenderness of the abdominal aorta may be present even without arteriosclerosis.

In cases of this kind, as well as in the pain of aortic insufficiency with arteriosclerotic base, treatment with sodium iodid over a long period is recommended with daily doses of 1 to 2 gm. The result is especially satisfactory in numerous cases of syphilitic origin.

The cooling apparatus so often used against pain does not give much relief, the application of hot compresses over the heart region being much more grateful (Th. Schott).

Pericardial Pain.—Pericarditis usually causes discomfort which

is localized in the region of the heart, and is described as a pressure; pronounced pain may be present, radiating into the arms and shoulders. Difficulty in swallowing, and pain in the epigastrium have been observed (Baumler).

In exudative pericarditis, pain is entirely absent, an important point in the differential diagnosis of pericarditis.

In adhesions of the pericardium to the heart, and in the indurated mediastinal pericarditis, pain plays no great part.

The treatment of pericardial pain primarily is that of the causa morbi. The rheumatic forms react promptly to salicylic preparations, which may also be tried in other forms.

Long continued effect of cold by means of the ice-bag or Leiter's cooling apparatus is of the greatest advantage. In people very sensitive to cold, and in children, the water is applied less cold. The cold has the advantage of slowing the heart, while warm appliances, although occasionally giving relief, increase the frequency of the heart. Counterirritants are employed; blistering of the precordial region with iodin and vesicants. It seems to mitigate the pain in some cases, without influencing the process itself, as was believed in earlier times.

2. Intrathoracic Vessels

Embolism.—Sudden pain, whose prominence recedes before the shock and violence of the dyspnea, accompanies emboli in the pulmonary artery or in its branches. When the main artery or its first branches are affected, death takes place almost instantly. In the smaller branches there results the picture of hemorrhagic infarct of the lung, whose pain, aside from that at the moment of onset, is due to irritation of the pleura.

Aortitis.—The region of the aortic arch may be the seat of violent pain, radiating into the arms and down the back, more seldom into the abdomen. If one is skeptical as to the existence of an isolated aortitis this pain may only be explained in this way, that the inflammatory process has attacked the adventitia, which is so rich in nerves.

Indeed, most of these cases are the result of exacerbations of a chronic progressive arteriosclerosis, less often of a primary acute inflammatory process. Real stenocardial attacks often occur, resulting, however, from involvement of the coronary vessels. The subclavian arteries sometimes participate in this disease process, becoming yielding, dilated, and pressing upon the brachial plexus, thus leading to radiation of pain down the arms. If the inflammation spreads from aorta to pericardium, a dry pericarditis sets in, giving rise to pain in the heart region. In rare cases it leads to abscess formation and suppurative periaortitis, which will be recognized by the violent pain

and increased temperature, as aortitis otherwise runs an afebrile course (Huchard).

Aneurysm.—Very painful conditions arise at times, due to aortic aneurysm, though until the moment of rupture, the aneurysm may cause absolutely no pain. The pain is caused by inflammatory processes in the adventitia, or simply by mechanical stretching and tearing of the sensitive end organs, extending into the outer vessel wall (Thoma).

Diseased nerves may cause a high grade of circulatory disturbance in the region of an aneurysm, and we see, therefore, a considerable increase in aneurysmal pain in complicating affections in the thorax (pleurisy, etc.).

If the aortic aneurysm has become very large, it may cause atrophy of the chest wall, as even the bony parts are destroyed. It is easily understood that the intercostal nerves under this ever increasing irritation answer with the most severe neuralgia. Since the upper two thoracic nerves run to the brachial plexus, accompanying the neuralgia there are radiations into the upper extremities. Dysphagia and severe singultus, with pain at the points of insertion of the diaphragm, are the acme of all possible painful sensations in aortic aneurysm. In aneurysm of the abdominal aorta there is pain extending into the back, but not into the breast.

To ameliorate the aneurysmal pain *antineuralgica* are advisable at first; still they have no effect in many cases, and it is necessary to use morphin for the pain of the almost distracted patient; in the early stages of the disease it is to be withheld when practicable. Leiter's cooling apparatus may be tried locally, as well as sedative plasters (belladonna plaster) and ointments.

Ortner prescribes:

Rp.	Menthol,	2.0
	Cocain muriat,	0.2
	Morph. muriat,	0.4
	Ol. olivarum,	1.0
	Lanolin,	20.0
M. Unguent.		
S. Salve.		

3. Syncopal Chest Pain

In the severe infectious toxic diseases, in abdominal typhoid and variola, by far most frequently in diphtheria, paralysis of the heart may result, showing various symptoms.

Children fall suddenly, lie motionless with the expression of mortal anguish in the face, with acute terminal symptoms of congestion (cold cyanotic extremities, congestion of the liver). Incessant vomiting

or diarrhea, high grade tachy- or brachycardia, frequently arrhythmia or at least embryocardia, usually complicate the picture. Often the weakness is less marked, and very violent pain is the chief symptom. Intelligent children often indicate the abdomen as the seat of pain; much less frequently the region of the heart. The cause of this may only be surmised. Perhaps the acute anemia of the heart and vessel-walls is an adequate stimulation—as, according to Nothnagel, is the ischemia of the intestinal musculature for the pain of colic—that painful sensation, which causes perfectly exhausted children to cry for hours.

The treatment consists in combating the heart weakness in the most energetic manner possible; in most cases, however, in vain.

4. The Pleura and Lungs

The Pleura.—The most frequent seat of intrathoracic pain is the pleura. Here a behavior is observed similar to that in the brain, where pain occurs only on involvement of the dura mater. We see affections of the parenchyma of the lung run their course without pain, until they reach the pleura. A cavity situated in the interior of a lobe causes no pain, while, in progressive ulceration, the overlying pleura becomes inflamed, and pain and tenderness result. It is even possible to determine the location of a superficial cavity from the sensitiveness to percussion. We cannot judge of the nature of a pleurisy from its painfulness. Postmortem findings show sometimes entirely fine, apparently fibrinous collections or only cloudiness, while, during life, severe knife-like pains have occurred on respiration, on coughing, or spontaneously. In other cases, one sees patients with enormous exudates who complain only of loss of appetite, weakness, headache, etc.

Even empyema of the thorax may, aside from severe dyspnea, cause only slight discomfort.

The pain in pleurisy is dull and continued, also knife-like and often exacerbations occur which resemble colic. The pain is most violent on coughing, sneezing, and deep respiration when the serous covering of the diaphragm is inflamed (diaphragmatic pleurisy). Tenderness may be present, though usually not of so high a grade as in periostitis of the ribs or in peripleuritis, spoken of below. Sensitiveness of the pleura on pressure is especially noticeable in wide intercostal spaces, such as occur in phthisis. The appearance of pain on the sound side is remarkable and has not yet been explained, any more than the constant occurrence of pain limited to one point in diffuse pleuritis. If intercostal neuralgia coexists, examination will reveal the characteristic points of tenderness.

Old adhesions may cause stitch in the side, due to tearing on deep respiration. Still one may relate it to such adhesions only when one has confirmed the small or hardly perceptible excursion of the lung by percussion or by radiology.

New formations of the pleura, as well as inflammations, lead to most intense pain, occurring primarily or secondarily; in these we have not only to think of pleural metastases, but of extensions of carcinoma and sarcoma of the lung.

The occurrence of pneumothorax is generally accompanied with such sudden violent pain that the picture may resemble an angina pectoris; the pain then recedes before the dyspnea, only to return more violently on the formation of a suppurative exudate. The pain and shock on the occurrence of pneumothorax is generally small in an emphysematous patient, and its course is usually favorable. After a few days the opening into the air becomes closed, and the lungs again fill the entire pleura.

Pleural pain is found finally in gouty individuals; it is not actually caused by uric acid deposits, but may develop in pleurisy insignificant *per se*, but which, on the basis of the arthritic disposition, develops into a local inflammatory process.

According to the observations of Head, affections of the pleura as well as those of other serous membranes, give no evidence of zones of hyperalgesia.

Against pleural pain, warm compresses, hot water compresses, ichthyol salve, 5 to 10 per cent., iodoform collodion, painting with tincture of iodin, vesicants, cupping, and immobilization methods by external means are used.

In the treatment of pleurisy in children, Biedert has recommended adhesive-plaster bandages. Others attempt to diminish the respiratory excursion by other means (binding, compression).

Antineuralgica are given internally, usually in single doses, and increased to two to three doses a day; antipyrin, 0.5 gm.; pyramidon, 0.5 gm.; antifebrin, 0.25 gm.; phenacetin, 0.25 gm.; analgen, 0.5 gm.; kephaldol, 1.0 gm.; antinervin, 0.5 gm.; exalgin, 0.25 gm.

In severe cases, when rest at night or expectoration suffers from the pain, morphin in doses of 0.01 gm. internally or by injection is given without delay. Nothnagel in his lessons always emphasized that morphin in large doses was the best expectorant.

The Lungs.—Knowledge of this indication is very important in the treatment of pneumonia, where the patient begins to cough only after the pain has been eased by the use of narcotics.

In croupous pneumonia, pain in the pleura is seldom absent. It usually occurs at the time of the initial chill, not remaining throughout the course of the disease, indeed often disappearing in a few hours

(Aufrecht). Sometimes it radiates into the abdomen, so that on the first day of a pneumonia the possibility of a perityphlitis is thought of; at other times the pain radiates into the healthy side. Pressure with the finger in the intercostal space is very painful, whereas the flat of the hand by immobilizing the side diminishes the pain noticeably.

It is a well-known fact that pneumonia of the upper lobe runs its course almost without pain, but causes severe nervous symptoms ("cerebral pneumonia"); farther, there is no pain in children, old people, and alcoholics who, as a result of the pneumonia, begin to suffer from delirium tremens. Acute pneumonia of the inferior lobes in persons of middle age is always associated with pleuritic pain (Aufrecht); chronic pneumonia, only on an acute exacerbation.

In chronic tuberculosis of the lungs, pain, though often not of a high grade, is seldom absent. There are various causes given for this pain. Sometimes pain in a circumscribed area precedes hemorrhage; this may occur for days in advance, so that patients suffering from a long-standing hemoptysis can predict the hemorrhage with certainty. It is clear that in view of the imminence of hemorrhage, the patients will not be permitted to use the steam bath, so much in favor in relieving the pain mistaken for rheumatic in origin (Cornet).

In the majority of cases we have to deal with creeping pleurisy, leading to the formation of adhesions, which sometimes may be recognised by a gentle rub, a probable grazing. Thus painful sensations may occur at the base of the lung on both sides in the axillary line, in the supra- and infraclavicular regions, in the precordium, and between the scapulæ.

Less harmful is the pain at the points of insertion of the muscles, caused by tearing, seen in phthisical patients on violent coughing, oftener, however, in the emphysematous.

In rare cases the occurrence of a pneumothorax is the cause of sudden violent pain In tuberculosis of the lungs, intercostal neuralgia also causes severe pain.

Even in the inactive stage, widespread formation of adhesions may cause pain on deep respiration; which, however, is capable of stretching the pseudomembranous threads and breaking them. After a pleuritic process, therefore, whether of tubercular nature or not, a methodical "terrainkur" is of greatest value.

According to the nature of the pain, antineuralgics, counterirritants, electricity, etc., will be used. As a symptomatic measure, Franklinization (electric wind) of the affected region is recommended (Cornet).

5. The Mediastinum

Diseases of the mediastinum are very seldom the cause of pain in the thorax. Dyspnea, oppression of the heart, singultus, and

dysphagia are observed much oftener than actual pain. Stitch in the side, retrosternal and parasternal pain, however, are seldom absent whether the case is one of hemorrhage into the mediastinum, suppurative mediastinitis, or tumor. Which of the three processes is present may be decided by the course of the disease which in the case of hemorrhage is a question of a few hours, of a few days in the case of acute inflammations, and, in the case of tumors, of months. The etiology, the inclination to hemorrhage, or the presence of a primary disease leading to mediastinal abscess, or of burrowing pus, assists in making the diagnosis.

In mediastinitis, violent pain often exists, sometimes of a pulsating nature. In mediastinitis anterior, radiation into the back may occur; in mediastinitis posterior, to the sternum, so that a localization according to the pain is impossible. Intercostal and plexus neuralgias occur in mediastinal processes, the first often, the latter very seldom.

From the hopelessness of the affection, the treatment is limited to mitigation of the pain by the administration of narcotics.

In the indurated mediastino-pericarditis, pain does not play a large rôle, the insufficiency of the heart ruling the picture. By the resection of a small part of the thoracic skeleton, proposed by Brauer (cardiolysis), all discomfort is decidedly improved.

6. The Bronchi and the Trachea

Bronchitis.—In acute bronchitis and in exacerbations of chronic bronchial catarrh the patients complain of pain along the trachea, into the jugular region, and behind the sternum. If severe coughing exists, with a tough secretion, violent pain occurs, resembling the pain of tumor in the diaphragm and in the intercostal musculature, especially on deep inspiration and on coughing.

In such cases a narcotic, as codein, is indicated; in children under two to three years this should be avoided and a decoction althæ or its like substituted. When a narcotic cannot be avoided, one must be very careful, especially in the case of infants, and prescribe:

Rp. Codein phosphoric, 0.005–.01
Aq. destill., 090.
Syrup diacodii, 10.0
S. 1 dessertspoonful every two hours.

v. Seifert recommends the following doses:

For the new-born, up to 0.0002 pro dosi.
For children up to 4 years, 0.01 pro die.
For children up to 6 years, 0.02 pro die.
For children up to 8 years, 0.04 pro die.
For children up to 12 years, 0.1 pro die.

The cough in fibrinous bronchitis may be exceedingly painful.

The catarrh in persons suffering from arthritis does not present many characteristic features—some patients asserting the bronchitis is very dry, others that it is extremely rich in secretion. The observation of Laennec is worthy of remark, that in these cases the pain is complained of chiefly in the region of the lower aperture of the thorax.

Bronchiectasis.—In bronchiectasis the pain may be entirely wanting, although Barth insists on its presence, believing that the seat of disease may be localized by this means (Hoffmann).

Bronchial Asthma; Stenosis of the Bronchi.—In asthmatic attacks and in true bronchial asthma patients scarcely complain of pain, but rather of oppressive sensations. In bronchiostenosis, on the other hand, pain exists, from the nature of the disease.

Carcinomatous strictures are accompanied by very severe pain on coughing; cicatricial strictures from syphilis, from inflammatory processes, such as perichondritis, necrosis of the cartilage, and lung abscesses with perforation into the bronchial tree cause only little pain.

If pain arises in the breast on coughing and swallowing, and if coughing occurs at once after the act of swallowing, the possibility of a carcinoma of the esophagus which has perforated into the bronchus must be thought of.

Foreign Bodies in the Bronchi.—Pain is especially important as a sign of a foreign body located in the bronchial tree. At the point of incarceration it arouses localized pain or only a vague feeling of pressure which gives way, on coughing, to the sensation just described. If the foreign body lies in the main bronchus, the patient will localize the pain in the second intercostal space on both sides, generally, indeed, over the seat of the foreign body; the bifurcation of the trachea corresponds to the middle of the sternum. A foreign body may be present months long in an insensitive person, leading to abscess of the lung and emphysema without the patient's complaining of pain. In the case of large bodies the pain extends along the bronchial tubes, while in small bodies it manifests itself first with the reactive inflammation.

The treatment consists in the removal of the foreign body, when possible, by means of the bronchioscope, otherwise by instituting vomiting; this latter may, however, as a result of the deep inspiration previous to the act of vomiting, increase the difficulty from aspiration into the finer branches. In cases where all remedies fail it is recommended rather to await results (Hoffmann).

Pulmonary Calculi.—Many individuals show a tendency to incrustation of the bronchial secretion leading to the formation of bronchial stone (Poulalion). If a stone thus formed attains considerable size, a feeling of pressure or a burning pain is felt which disappears at once

if the concretion is dislodged by a violent paroxysm of coughing. Many authors have designated this phenomenon as "stone asthma" or as "bronchial colic," according as the dyspnea or the pain was the most prominent.

Swelling of the Bronchial Glands.—In addition to the diseases of the bronchi, we shall consider affections of the tracheo-bronchial and broncho-pulmonary lymph glands. They are affected in almost all tubercular processes in the lung without causing special symptoms. Only when they are severely attacked, as especially in children, do they play a rôle in the picture of the disease. There occur peculiar attacks of coughing, resembling those in pertussis, stridor, pain along the sternum or both sides of the spinal column. The area of dulness which one would expect to find theoretically fails in most cases (see Widerhofer, Henoch, Schlossmann). Perhaps radiology will throw some light on these cases; still in most typical clinical pictures often no shadow is revealed.

The treatment consists in giving cod-liver oil, ferrum iodatum saccharatum, or syrup of the iodid of iron; rubbing the thorax with green soap mixed with vaselin in the case of very young children.

Ferum iodatum saccharatum, according to Montis, is appropriately given in the following doses:

Rp.	Ferr. jodat. sacchar.,	0.5–1.0–20
	Pulv. rad. rhei,	0.4
	Sacchar.,	2.0
	Div. in dos. X.	
DS. Three powders daily.		

For older children he recommends:

Rp.	Ferr. pulver,	1.0
	Jod. pur.,	2.5
	Aq. destill.,	gutt. X
	Sacchar.	
	Pulv. Rad. Althæa,	āā 5.0
M. f. pilul Nr. C.		
Obducantur Balsam tolut.		
DS. Three times a day 1–3 pills.		

Seifert recommends a 5 per cent. iodin-iron syrup:

Up to 2 years,	1 to 2 drops *pro dosi*
From 2 to 5 years,	3 to 10 drops *pro dosi*
From 5 to 10 years,	10 to 15 drops *pro dosi*
From 10 to 15 years,	15 to 20 drops *pro dosi*

Monti gives 3 to 4 teaspoonfuls a day, but observes digestive disturbances on long-continued use.

7. Esophagus

Thoracic pains due to diseases of the esophagus will be discussed in the section on "Obstruction in the Food Passages."

Clinical investigation of the light transitory affections of the esophagus is not at all advanced at the present time. Thus we know very little concerning the difficulties in swallowing in young children due to acute esophagitis, although Billard called attention to the condition long ago. Severe inflammations of the esophagus with violent pain, which is independent of the act of swallowing, are indeed described; thus the esophagitis exfoliativa and phlegmonosa, which may be diffuse or circumscribed, leading to abscess formation.

Thrush of the esophagus may cause pain on swallowing. In carcinoma of the esophagus the pain on swallowing will be felt behind the body of the sternum or along the ensiform process, depending on the location of the tumor. According to the observations of Rosenheim, pain may be deceptive as to the seat of carcinoma and may change its location. This does not depend altogether upon the tumor itself, but upon the tetanic contractions developing on account of it, analogous to the stiffening of the intestine from intestinal stenosis. In rare cases stricture following tubercular ulcers cause pain; this occurs more frequently after syphilitic disease.

In inflammatory processes of the mucous membrane of the esophagus, following the advice of Rosenheim, we may introduce a soft stomach-tube, which has been rubbed with cocoa butter containing 3 to 10 per cent. tannin or 2 to 5 per cent. silver nitrate. For sedative effect, cocain or anesthesin may be added to the cocoa butter, especially before the taking of food. For instance:

Rp.	Morph. muriat.,	0.1
	Cocain muriat.,	0.5
	Butyr. cocoa,	20.0
	S. Paste for external use.	

8. Intrathoracic Nerves

Injury to vital nerves passing through the thorax generally causes no pain, but changes in the heart action, vomiting, singultus, and symptoms due to irritation of the sympathetic nerve. The phrenic nerve, however, may sometimes cause an undoubted neuralgia (Strümpell), and the patients can trace the anatomical course of the nerve to its distribution in the diaphragm. One finds corresponding points of tenderness, externally, from the sternocleidomastoid along the sternum to the attachment of the diaphragm (Bernhardt).

During an attack of pain, patients press the flat of the hand against the thorax in the region of the insertion of the diaphragm in

order to immobilize it and generally hold their breath. The left side is affected oftener than the right. Disorders of the heart, pericardium, great vessels, and spleen indicate involvement of this side, while on the right side pain in the liver is the only symptom.

The abdominal organs are affected through irritation of the phrenic nerve from the fact that its branches pierce the diaphragm to supply the capsule of the liver and spleen. It is the same with all other neuralgias of an infectious, toxic, or rheumatic nature.

The prognosis depends upon the primary disease. The most dangerous neuralgias are those accompanying angina pectoris; in these attacks the characteristic sensation of annihilation will call attention to the true nature of the disease. On the other hand, neuralgias occurring in malaria as a result of the toxin or of the tumor of the spleen are usually quick to disappear.

The treatment consists in removing the cause and at the same time in mitigating the pain through counterirritants (mustard plasters, cupping), antineuralgica, and in the worst cases morphin. Faradization or galvanic treatment with small current, employing the anode, may also be tried. "The favorable effect is generally rapid and striking; where no improvement takes place after the first sitting one cannot reckon upon success by further treatment" (W. Erb).

9. Bones, Periosteum, and Joints

Affecting the ribs, sternum, and spine are fractures, dislocations, acute osteomyelitis, and sarcoma. The pain is especially severe when the intercostal nerves are irritated mechanically or by inflammatory involvement. One sees occasionally neuralgia resulting from the pressure of a callus in a badly healed fracture of the ribs.

Cold abscesses following caries of the lower portion of the sternum are sometimes almost impossible to diagnose.

Relief is obtained in tubercular processes by operative measures (excochleation, resection); in syphilis one must follow the excochleation by the specific treatment.

v. Hampeln has drawn attention to the thoracic osteal gias which, without demonstrable cause, appear at the ensiform process and in the region of the false ribs, and, on account of their severity, remind one of angina pectoris. According to his view, the uric acid diatheses may play some part in the process. In these cases one will prescribe salol and the usual dietetic measures against gout.

We shall consider at this time a rare disease picture with pain in the sternum, first described by Nothnagel. It is the lymphadenia ossium, which begins with tenderness along the body of the sternum, then in other bones. Attacks of pain, ever becoming more frequent,

come on; the sternum becomes markedly thickened and a proliferation of the lymphadenoid tissue takes place in the bone marrow.

Painfulness of the bones is well known, especially in rickets of the thorax and in certain forms of osteomalacia, as well as in the Morbus Barlow, so seldom seen in our region.

The treatment of rickets consists in the phosphorus medication of Kassowitz.

Rp. Phosphor, 0.01
Ol. jecor. aselli, 100.00
DS. One desertspoonful once each day.

Further, salt baths and an appropriate diet, as well as a plentiful supply of fresh air and sunlight, are effective curative factors and not to be underestimated.

In the osteomalacia of multiparæ, guarding against further pregnancies is the most important therapeutic measure; even castration must be considered in severe cases.

The joints in the region of the thorax are only seldom attacked by rheumatic polyarthritis; the sternoclavicular articulation most frequently, then the articulations of the vertebræ.

The sternoclavicular articulation may, in rare cases, become the seat of uric acid deposits; chronic arthritis deformans of the spinal column is accompanied by violent intervertebral neuralgias, evoked by pressure.

In acute, subcutaneous, and chronic articular rheumatism, prominences in the supraclavicular hollows are observed, at times associated with great pain. Especially in the acute form of rheumatism these swellings are so transient that they are to be regarded only as angioneurotic edema; in chronic cases we may have various changes, such as accumulation of fat (Verneuil) or inflation of the apices, etc. From pressure on the brachial plexus, cervico-brachial neuralgias of great severity result.

10. Musculature

Traumatic Pain; Tetanus.—Slight pain in the region of the thorax, or even more severe but insignificant, is often of muscular origin. Thus the pain which occurs after violent muscular exertion, the pain at the insertion of the diaphragm, in the shoulder-girdle, and in the intercostal muscles, in patients suffering from emphysema and bronchitis, take their origin from the forced attacks of coughing which cause strain on the respiratory muscles. The violent pain which patients affected with tetanus feel in the region of the heart is probably to be explained in this way also. In this disease the respiratory musculature is always

more or less affected, and the board-like tension of the abdominal walls necessitates an especially forced action of the diaphragm in order to make a descent possible on inspiration.

Waxy Degeneration.—A finding not uncommon in severe diseases is the waxy degeneration of the striated muscle tissue. It occurs most often in the muscles of the abdomen (rectus abdominis), and in the adductors; it often attacks the respiratory muscles also, leading to insufficiency of respiration not only from the loss of power which the muscles undergo, but also from their inability to functionate on account of the great pain. This degeneration, lately studied by Zenker, occurs regularly, in severe abdominal typhoids, in the second or third week; also in septic and pyemic processes (Lorenz), as well as in other infectious diseases pursuing a fatal course; thus in tetanus, in which one may interpret it as the effect of the toxin, as well as of the forced muscular action.

Dermatomyositis.—A rare disturbance, leading to severe pain in the thoracic musculature, is dermatomyositis, an infectious disease *sui generis*, calling forth violent muscular pain in the entire musculature of the body, above all, however, in the pectoral and intercostal muscles. The general picture, with swelling and painfulness of the muscles and the characteristic points of predilection, often resembles trichinosis, which may be differentiated only by the microscopic findings of a muscle and the previous intestinal symptoms.

The treatment consists in ameliorating the pain by antineuralgica, Priessnitz compresses, and eventually morphin; the cases are usually fatal.

Trichinosis.—Trichinosis, too, attacks preferably the muscles of the diaphragm and the intercostal muscles, and on this account often leads to great pain on respiration.

The prophylaxis in trichinosis consists in examination of the meat and in avoiding uncooked pork or that too little pickled or smoked.

In the stage of the intestinal symptoms one endeavors, through laxatives, to cause evacuation of the trichina. Still this measure unfortunately does not protect against invasion of the musculature, but perhaps renders it milder. It is necessary to use vermicides. Fiedler and Merckel give glycerin (one tablespoonful every hour), while Mosler and Peiper recommend benzene, thus:

Rp.	Benzol,	6.0
	Mucilag. gummi arab.,	25.0
	Succi liquirit.,	8.0
	Aq. menth. piperit.,	120.0

S. Shake well. One tablespoonful every one to two hours.

According to Mosler and Peiper, santonin may be prescribed in the following combination:

Rp. Santonin, 0.02–0.05
Calomelanos,
Tuber jalap.,
Sacchar., āā 0.5
M. f. p. D. tal. Dos. Nr. VI.
S. One powder twice a day.

For the pain in the muscles, long-continued warm baths, chloroformoil rubs, and Priessnitz compresses may be employed.

Myositis Ossificans Multiplex Progressiva.—A very rare disease appearing mostly in childhood or youth, leading to pain, especially in the muscles of the back and neck, is the myositis ossificans multiplex progressiva. The inflammatory infiltration in the muscles forms in time horny nuclei which may be palpated; they finally assume odd forms. It is rare that inflammatory symptoms and pain are entirely absent. The latter is usually more severe at night.

Treatment by baths and application of iodin may improve the inflammatory symptoms, but we are helpless against the slow progressive ossification process.

Muscular Rheumatism.—Among the muscular pains not directly dangerous occurring about the thorax and back, acute and chronic muscular rheumatism may be mentioned. The first resembles acute articular rheumatism very much and, like it, may be complicated by endocarditis (v. Leube), but does not react so promptly to the salicylates.

11. Nerves of the Thoracic Wall

In a great number of the diseases mentioned in this chapter, intercostal neuralgia may occur symptomatically, as in enlarging tumors pressing against the breast wall (aneurysm), in rib affections of all kinds (caries), and in peripleurisy. Diseases of the spine, whether of tubercular, syphilitic, chronic deforming, carcinomatous, or sarcomatous nature, lead to intercostal neuralgia owing to injury of the nerves at their point of exit from the spinal canal.

In carcinoma of the organs an intercostal neuralgia is often the first symptom to point to a metastasis in a vertebra.

In rachitis intercostal neuralgia is observed only in cases of a high grade of kyphoscoliosis; it usually occurs on the side of the convexity.

Sometimes curvature of the spine from arbitrary resting of the weight on one side may cause intercostal neuralgia.

Intercostal neuralgia is observed oftener on the left side than on the right. Henle believes he can trace this behavior back to anatomical conditions. At the point of exit of the nerves from the spinal canal there is a network of veins which on the left side pour their blood into the great veins after a more circuitous route than on the right side.

The diseases of the spinal cord and its membranes play an important rôle as etiological factor; also diseases of the female sexual organs (according to Seeligmüller), constitutional anomalies, as anemia, hysteria, poisoning (lead) acute and chronic infectious diseases (influenza, malaria, syphilis), and finally the questionable "rheumatic poisons."

In syphilitic individuals especially intercostal neuralgia occurs on both sides with exacerbations at night; this reacts promptly to the syphilitic treatment.

Not seldom the intercostal neuralgia is followed by a herpes zoster, by which, then, the diagnosis is established.

The three points of Valleix—the spinal column, the middle of the intercostal spaces and along the sternum—are very characteristic.

According to Romberg, the painful "girdle sensations" of persons addicted to the use of tobacco belong to the initial symptoms of tabes dorsalis. The patient has the sensation of a very tight girdle bound about him, in some cases higher, in some cases lower. Symptomatic treatment must always proceed with the fundamental disease in mind. In tubercular spondylitis, methods for extension are of value; in syphilis and malaria the specific medication; in anemia, preparations of iron and arsenic; in hysteria, suggestion.

Following Edinger's advice, one may employ the chlorethyl spray for the pain. After that, antineuralgica, faradization, counter-irritants, nerve stretching (Nussbaum, Nägeli), and even nerve section are to be considered.

12. The Mammary Glands

The mammary gland, especially in women, is often the seat of painful surgical diseases. Galactostasis, mastitis, and tumors, above all, carcinoma must always be excluded in pain of the breasts. There are severe mastodynias, very often without objective findings, if we disregard the small neuralgic neurofibroma of Romberg.

These disturbances usually occur in elderly women with hanging breasts in which circulatory disturbances have developed as a result of badly fitting corsets. In anemic and neurasthenic constitutions one tries arsenic, iron, quinin, support of the breasts and keeping them warm. Nägeli recommends a stretching of the whole gland toward different sides. In the severest cases one must decide upon amputation even, as the patient otherwise falls into morphinism.

13. The Skin

Rhagades of the Mammilla.—That the skin affections may be very painful we see from a symptomatic herpes zoster accompanying an

intercostal neuralgia. Among other skin affections, the fissures of the nipples in nursing women must be mentioned. They are important because they open up a means of entrance to germs, and therefore may lead to mastitis; but their painfulness is also of importance, for they are the cause of many young mothers ceasing to nurse their children.

It is therefore recommended that these fissures be cared for in the interest of the natural nourishment. One employs a nipple shield, paints the fissures with silver nitrate or paints the nipple with tannin glycerin. A 1 per cent. silver nitrate and 10 per cent. balsam of Peruvian salve may also be applied.

Head's Zones.—We wish finally to speak of the hyperalgesic zones on the skin of the thorax in deep-seated disease processes.

According to Head, one finds:

In heart disease a zone of hyperesthesia in the supraclavicular, infraclavicular, and mammary regions; in pulmonary tuberculosis in the second to fifth intercostal spaces; in affections of the mammary, gland, in the fourth and fifth intercostal spaces; in stomach diseases, in the sixth, eighth, and ninth intercostal spaces.

The frequent presence of pain at the left of the spinal column or between the shoulder-blades is well known in ulcus ventriculi. The hyperesthetic zone in esophageal affections corresponds to that of stomach affections, only it lies somewhat higher.

Of importance are the unilateral sensory disturbances very strongly marked in unilateral lesions of the spinal cord and in hysteria.

In unilateral lesions the anesthetic portion of the body, as well as the paralyzed, ends above with a hyperesthetic band.

CHAPTER V.

COUGH

PURPOSE AND ORIGIN OF THE REFLEX

Coughing is a reflex process whose purpose is to prevent the entrance of foreign bodies into the air-passages and to remove collections of secretion within them. It completes at the same time the action of the ciliated epithelium, through which the purging of the finer air-passages into the trachea is effected and advances the mass so directed into the mouth.

After a deep inspiratory movement a cramp-like expiration results in which the abdominal muscles take a great part. The glottis is closed, but the closure is burst open by the pressure of air causing the air to rush forth with great rapidity. In this way solid, liquid, or gaseous contents of the trachea and great bronchi can be brought out.

The sensory stimulus to cough in general lies in the ramifications of the vagus nerve toward the "cough center" which lies in the fourth ventricle on both sides near the raphe, in the region of the ala cinerea. Clinical experience leads us to infer the immediate neighborhood of the vomiting center to which the stimulus to cough easily radiates.

REGION EXCITING COUGH

Stimulation of the larynx above the rima glottidis does not produce coughing. There occurs in this case the much more appropriate closure of the glottis, by which means the entrance of a foreign body into the air-passages from above can be prevented.

From the rima glottidis downward cough may be produced, especially from the bifurcation onward, from the posterior wall of the trachea, and from the interarytenoid mucous membrane. The parenchyma of the lung itself can cause no coughing, although the pleura may, as is shown convincingly in tapping if the point of the needle scratches the pleura.

Stimulation of distant nerve regions are mentioned by various authors as producing cough. The auricular vagus nerve of the external ear-passages, the ramifications of the trigeminus in the nasal mucous membrane, even regions supplied by very distant nerves (liver, spleen, stomach, intestine, uterus, mammary gland, ovaries,

certain parts of the skin) are said to be able to bring out this reflex.

Undoubtedly many persons cough from stimulation of the pharynx and back of the tongue.

Whether in all of these cases there is a direct reflex from the "cough center" or whether we are concerned with an influence of the bronchial mucous membrane is still undecided, as is the problem of "nervous coughing." We have not the possibility at hand of showing that we have to deal mostly with a very low threshold of irritation in the regions supplied by nerves of the respiratory mucous membrane by which very slight inflammatory stimuli, otherwise not noticeable are sufficient to produce results. We shall speak of hysterical coughing later.

PATHOLOGICAL DISTURBANCES OF THE REFLEX AND ITS DANGERS

Before going into the pathology of this normal reflex, we shall speak of those diseased conditions which hinder the occurrence of cough and so give rise to severe injury to health.

While acute inflammatory processes of the respiratory mucous membrane greatly increase the sensitiveness of the sensory nerves, chronic processes often diminish it considerably. In chronic bronchitis and ulcerous phthisis one often hears the rattle of the secretion throughout the whole room, and yet the patients do not cough for hours at a time.

Cough is absent in all diseases which make closure of the glottis impossible, above all in paralysis of the glottis closers, and also in paralysis of the expiratory muscles.

Pain of any degree on coughing leads to its more or less complete suppression. General muscular weakness and torpor, often lead to pneumonia and death as a result of the absence of cough.

It is the incapability of coughing which leads us to fear widespread bronchitis, especially in children of poor vitality, in marantic old people, and in those weakened by disease.

DANGERS OF THE PAROXYSM OF COUGH

If we consider the dangers accompanying absence of cough, the threatening factors of cough itself appear insignificant to us.

Cough may injure health in two ways:

1. By repeated overexpansion of the lungs.
2. By enormous increase of the blood pressure.

The first-mentioned danger plays a part only in disease with long-continued cough; *i.e.*, for months or years. The elasticity of the lung

tissue at every attack of cough is given a test of endurance, mostly in the supraclavicular regions, where one may see, in old emphysematous patients, prominences resembling air-cushions appear before each attack.

After even a few weeks of violent cough a volumen pulmonum auctum develops, and after years a substantial emphysema results from this affection. Especially in tubercular individuals with foci in the superficial portions of the lung, a pneumothorax may suddenly develop in apparent health during a violent attack of cough.

Finally, especially in children with bronchitis, the heightened alveolar pressure leads to bursting of the septa and entrance of air into the interstitial and mediastinal connective tissue (interstitial emphysema of the lungs).

Moreover, violent cough leads to a high grade of venous congestion, as one may observe most clearly in the veins of the neck in patients suffering from heart disease and also in cases of too frequent increase of the arterial blood pressure. This rise in blood pressure is generally well borne, though the appearance of a severe pertussis at times illustrates the contrary. Wherever the vessels possess a locus minoris resistentiæ, hemorrhage may occur, which becomes ominous on account of the magnitude (aneurysm) or location (hemorrhage of the brain. Severe cough may also endanger life if an empyema of the thorax has perforated into the bronchi. The patient can expectorate only very gradually, so that the bronchial system is simply flooded by the masses of pus. The more the patient coughs, the more profusely the pus streams into the bronchi as a result of the expiratory rise in pressure, and such a circulus vitiosus can only end in death.

KINDS OF COUGH

Cough is a symptom an estimation of whose significance is only possible after careful examination of the chest and inspection of the nose and pharynx; under certain conditions laryngoscopic examination as well as macroscopic and microscopic findings in the sputum must be added. Above all, in a beginning tuberculosis of the apex a worthy judgment as to the disease is possible only after a longer observation of the general condition, especially of the relations of the body weight and body temperature, and often after the use of the diagnostic tuberculin reaction.

Nevertheless, the old physicians were able to draw conclusions from the character of the cough, and we should not underestimate the semiology of the timbre of the cough.

Moist, Dry Cough.—It is easy to determine whether or not an attack of cough dislodges secretion in the air-passages. Even the

laity recognize a moist or a dry cough; in the latter case either there is no secretion present worth mentioning or it is so tough that it adheres immovably to the mucous membrane.

Barking Cough.—The barking cough is also known to the laity. This occurs on swelling of the vocal cords from any cause and is not characteristic for any disease. In children it is likewise a sign of involvement of the larynx in croupous inflammation, and a favorable diagnosis (laryngitis) is only to be given after thorough examination. The voice is almost never clear; it may be that the barking tone is produced by swelling of the false vocal cords or of the subglottic mucous membrane, and that the vocal cords themselves close promptly.

Hysterical cough is often of a pronounced barking character, and is often observed in young girls; the attack passes at once into a sound imitating the bark of a dog (Sahli). Less pronounced is the timbre of the cough in all changes of the linear margins of the vocal cords, whether from debris or ulceration.

Metallic Ring.—Occasionally the cough possesses a metallic sound; thus, in laryngeal croup, when partially detached membranes float in the larynx or if a foreign body is wedged in it, which is somewhat mobile.

Hollow Cough.—The cough sounds hollow if a resonant space resounds, whether it be a great cavity or the mouth cavity; thus in insufficient closure of the glottis the cavity of the mouth possesses an increased pressure and a bursting of the closure takes place into the mouth. This form of cough is found in greatly advanced phthisis.

Noiseless Cough.—If closure of the glottis is impossible as a result of widespread loss of substance in the vocal cords or paralysis of the closer of the cords (laryngeal tuberculosis, postdiphtheric paralysis) the cough then is entirely noiseless or, in less pronounced cases, peculiarly weak. The nature of the cough is similar when general muscular weakness or paresis of the abdominal muscles makes powerful expiration impossible.

Pertussis-like Attacks.—Of almost pathognomonic significance is, in general, the whooping-cough attack. After a few short, strong expiratory movements, which follow each other always faster and faster, comes a deep, crowing inspiration, which is resonant as a result of the proximity of the vocal cords; the insufficient entrance of air may be recognized by the retractions in the jugulum and at times in the thorax and epigastrium. This process repeats itself usually several times until, perhaps, stringy mucus is thrown out or vomiting occurs.

In infants the most severe attacks run their course *without* resounding inspiration; in adults the cases are very light and only the occurrence of an epidemic makes the diagnosis possible ("Coqueluchette").

Swelling of the Bronchial Glands.—The cough occurring in swelling

of the bronchial glands is very similar to true whooping-cough, so that in such an inflammatory bronchial adenopathy we should expect to find the anatomical substratum for the true pertussis (Gueneau de Mussy).

Laryngeal Crises: Ictus Laryngis.—The laryngeal crises of tabes may be mentioned here, in which at first there are nervous paroxysms of cough and laryngospasm, and later paralysis. Only the often observed cyanosis and the crowing inspiration call to mind slightly the attacks in pertussis. Sometimes such attacks end with loss of consciousness, collapse, and convulsions. In these cases the attacks are probably of epileptic nature or epileptiform.

Hacking Cough.—Attacks of slight cough, often repeated, with little expectoration occur. One meets with this in chronic pharyngitis and laryngitis, in beginning tuberculosis of the apex, and in many forms of nervous cough, as chorea laryngis; finally in the dry cough of goiter, and at times in Graves' disease.

In all of these cases, small secretion and the continual irritation to cough are common.

WHEN SHOULD COUGH BE COMBATED?

We have above characterized the conditions in which cough may become dangerous; the cases are much more frequent, however, in which cough signifies no danger, yet is a very undesirable symptom. In every bronchitis, the irritation to cough exceeds the desirable or necessary limit, and the patients may become weakened or exhausted. By stimulation of the reflexes, according to the well-known physiological law, the cough becomes progressively more easy and more frequent; it is preferable, however, to keep an inflamed organ still. One must, therefore, always estimate, from the study of the physical findings and the nature of the expectoration, the necessary strength and frequency of the cough. If the cough does not accomplish the removal of secretion it is certainly not advantageous. Indeed, through the deep inspiration before the expiratory movement, the secretion may even be aspirated, and, according to its nature, lead to atelectasis or infection. Also the variation in the blood pressure in the vessels of the lung is to be looked upon as a force influencing the nutrition of the organ unfavorably.

From this there follows the indication to combat every inefficient cough, and to employ stimulation of this reflex only when a blocking up of secretion threatens.

SPECIAL INDICATIONS FOR TREATMENT OF COUGH

The affections of the upper air passages down to the finer bronchi often condition a violent irritation to cough, which, when stimulated

by particles of mucus above the glottis, is entirely in vain; while in affections of the lower passage, it is out of all proportion severe.

Pharyngitis; Laryngitis; Tracheitis; Diffuse Bronchitis.—In acute pharyngitis and laryngitis we have for amelioration of the irritation to cough, first inhalations, containing narcotic ingredients as morphin or cocain in 1 per cent. solution; aq. Laurocerasi in 5 per cent. solution.

Tough secretion demands addition of expectorants as, for instance, sodium bicarbonate in a solution up to 2 per cent., salt up to 3 per cent., and, finally, oil of turpentine, ol. pini pumilionis. In this case mineral waters (Ems, Selters, Gleichenberg) with hot milk afford relief.

It is sometimes of great advantage to give the advice to suppress the cough as much as possible, since reflexes always return more easily on a much traveled path.

Sometimes the uvula, lengthened by inflammatory swelling, especially in the lying position, irritates the aditus ad laryngem, and then the irritation only ceases when the backward sinking of the uvula is prevented by raising of the head.

At times, especially in nervous individuals, one does not succeed without the internal use of narcotics. In such cases Naunyn recommends morphin hydrochlorate in 1 per cent. solution to be mixed with a little water; ten drops of this should be slowly swallowed. In this way, owing to the remote action on the central nervous system, there is a local ameliorating effect, one may get results from smaller doses. Good results are observed also from codein hydrochlorate or phosphate in single doses of 0.01 to 0.03 gm., two to three times a day, or from heroin (0.003 to 0.005 pro dosi).

Croupy Cough.—If the cough is of a barking character, then mere inspection of the pharyngeal organs is entirely insufficient to exclude diphtheria of the larynx as, for instance, from absence of a membrane. By pressing down the base of the tongue with a spatula, one may bring the epiglottis into view, and in a certain number of cases discover a white rim on the free edge to confirm the suspicion of diphtheria.

In many cases examination by means of the laryngoscope gives the true differentiation between simple catarrhal and croupous laryngitis, in others only the bacteriological examination.

In doubtful cases it is always advisable to give the benefit of the doubt to the worse diagnosis, and inject a large dose of serum (perhaps 2000 I. U.).

Gradual onset and slowly increasing discomfort always speak rather for croup; sudden onset from entire state of health, with changes in the intensity of the symptoms, justifies the hope that it

is a case of laryngeal catarrh, as at night this sometimes leads to pseudocroupous attacks without causing any disturbance by day.

Absence of fever in no way speaks against diphtheria, as it often runs its course with less fever than catarrhal laryngitis.

Also measles is accompanied by croupous attacks, which in the prodromal stage usually have no significance, but appearing at a later period must always awaken the suspicion of secondary infection with Loeffler's bacillus. A foreign body is also to be thought of, above all, with sudden onset of barking cough, and severe laryngostenotic symptoms. In this case, the extraction of the foreign body is to be attempted.

To ameliorate the symptoms, moist air, steam compresses about the neck, and inhalation are to be tried. For inhalation in croup, aqua calcis is recommended; still it has not fulfiled the hope that separation of the false membrane would be effected by its use.

Acute Bronchitis in Adults.—The bronchitis of adults and that of children require special consideration.

In adults the danger of the development of capillary bronchitis and of bronchopneumonic foci is not so imminent as in young children.

At the time when yet but little tough secretion has formed (sputum crudum), the irritation to cough may be combated by the use of sedatives, as morphin, codein, heroin, etc., and only on the presence of numerous moist rales are the usual resolvents and expectorants employed. Thus Liebermeister's mixtura solvens stibiata.

Rp.	Ammon muriat,	5.0
	Tartar stibiat,	0.05
	Aq. Fœniculi,	185.0
	Succ. Liquirit,	10.0
MDS.	One tablespoonfull every 2–3 hours.	

The effect of these medicaments is questionable; still in those cases where vomiting is stimulated, they doubtless cause expulsion of masses of mucus from the big bronchi.

Liquefaction of the secretion is not to be expected from them, rather from sodium iodid in daily doses of 2 gm. in mixture; farther, from sodium hydrocarbonate, as well as mineral waters containing salt.

Bronchitis of the Finer Bronchi.—If the catarrhal inflammatory process attacks the finer bronchi, then our treatment is limited to the provision for deep, expanded respiration. In order to promote this, luke-warm baths are recommended with showers on the neck, partial bathing, and friction. The patients must change their position in bed frequently; coughing must be encouraged, and the general state

of health must be maintained. Especially the power of the heart demands careful watching.

"Expectorants" are to be avoided in threatening heart weakness. Liquor ammonii anisatus deserves the most attention as it serves as an irritant to cough, and stimulates the heart at the same time.

It may be prescribed in a mixture of 2 gm. to 150 water.

Bronchitis in Children.—This refers in general to the treatment of only slightly developed bronchitis in the young.

Under no conditions are narcotics to be given, as the reflex irritability of the respiratory mucous membrane sinks under their influence until a blockade of secretion is to be feared. Of inestimable value are baths, with cool neck packs and cross bandages.

Expectorants: Inf. Ipecacuanhæ 0.2 to 0.3 : 100, mixed with 20 drops liquor ammon. anisatus and 0.1 to 0.2 gm. caffein.

In heart weakness digitalis, strophanthus, wine, camphor, and mustard baths; also mustard water packs, according to the recommendation of Heubner.

The children should occasionally be carried about.

Hermann's proposal appears rational—namely, to undertake artificial respiration for half an hour several times a day, or to have the children's parents practise it after demonstration on the part of the physician; it is perhaps advisable to undertake the artificial respiration at shorter intervals (of two to three hours perhaps), but never for more than five minutes. He supports the expiration through compression of the false ribs with the flat of the hand, thereby deepening the respiration and improving the expectoration.

Bronchopneumonia.—Catarrhal pneumonia is to be treated in the same way as capillary bronchitis. Both disease pictures gradually merge into each other, and in every fine bronchitis of long duration and severe general symptoms the existence of bronchopneumonic foci is understood.

Croupous Pneumonia.—In croupous pneumonia the treatment of the cough in the stage of hepatization is very different from that after the crisis. It is evident that the rigid exudate is not to be dislodged from the alveoli by coughing, and that the irritation to cough, whether caused by the pleura or mucous membrane, hurts the already exhausted patient. In this stage morphin in small doses is indicated. The painfulness of the cough and the steady frustrating irritation then disappear. It is possible that the patient at greater intervals and of necessity will cough violently, and thereby remove more secretion from the bronchi, than by the incessant coughing half restrained by pain.

If the pneumonia is resolving, when numerous moist râles occur, one may make use of the customary expectorants. Still in the *resti-*

tutio ad integrum of the pneumonic lung the resorption certainly plays a greater part than the expectoration, a fact which may be observed repeatedly, above all in children. Without much cough or expectoration, the dulness disappears.

Bronchitis in the Aged; Hypostatic Pneumonia.—The tendency of old, decrepit individuals to hypostatic pneumonia deserves special attention. Here it is important to provide for expectoration by promoting coughing and by expectorants; and for the maintenance of the power of the heart and for frequent change of position. It is best to have such patients sit up for an hour, now and then, in an arm-chair. Certain expectorants as apomorphin are contraindicated, as they easily lead to collapse.

Violent attacks of cough, with an existing affection of the blood-vessels of the brain, may cause one to fear an apoplectic stroke. In these cases one will hardly dispense with giving codein hydro-chlorate up to 0.01 gm. pro dosi, or some other desirable sedative.

Putrid Bronchitis.—If the secretion has undergone putrid decomposition, its evacuation must be accomplished as completely as possible. As a result of violent coughing spells, aspiration of decomposed secretion may occur into a territory of the bronchial tree previously healthy.

Narcotics are to be used only in cases of pressing necessity; the most suitable is probably oil of turpentine as inhalation, and internally as high as 20 drops a day.

For internal use, terpin hydrate is recommended.

Rp. Terpinhydrat., 1.0
Spirit vini, dil.,
Aqu. menth. pip.,
Syr. rub. idæi, āā 50.0
S. A tablespoonful three to six times daily; for children a teaspoonful.

Pulmonary Tuberculosis.—Many phthisical patients do not suffer from cough at all, others very considerably. In these cases great individual variations occur.

Cough exceeding the requisite amount injures the parenchyma of the lung, leads in time to emphysema, may give rise to hemoptysis or pneumothorax and to the spreading of infected material to the place of least resistance; *i.e.*, to the apices of the lungs devoid of bony encasement.

The phthisiotherapeutist has all cause to inhibit cough as much as possible.

The educational method is of great advantage. The patient has to learn to suppress the cough, either by deep regular inspiration or by a "moistening" by the use of cough lozenges.

In institutions for tuberculosis it is remarkable how little the patients cough.

To especially sensitive individuals different sedatives should be given, best changed from time to time; for instance:

	Ext. cannab. indic.,	t.i.d. 0.05
or	Ext. hyoscyami,	t.i.d. 0.05
or	Codein phosphor.,	t.i.d. 0.02–0.03
or	Ext. opii,	t.i.d. 0.01 u. s. w.

In hopeless cases, morphin injections should not be spared.

When hemoptysis has occurred, cough is very undesirable. If the hemorrhage stops one should encourage the patients, who are usually very anxious, to cough with great care. The coagula, however, should be coughed out. Expectorants are usually unnecessary; the patient must only trust himself to act upon the irritation to cough.

Pertussis.—In no disease is there so great an indication to combat cough as in whooping-cough; for most of the complications of this disease are not due to the toxic effects of the disease-producing organism, but to the increase of air pressure in the lungs and the rise of blood pressure during the attacks.

Thus volumen pulmonum auctum arises, apparently after a few weeks' duration of a violent pertussis; farther, the increased pressure in the pulmonary circuit may lead to dilatation and hypertrophy, or to enfeebled heart and death. Increased blood pressure is very ominous when combined with a diseased condition of the vessel wall. Such hemorrhages result from this condition, as to endanger life from their violence (epistaxis), or from their location (brain, spinal cord, anterior chamber of the eye).

Increased abdominal pressure favors the appearance of hernias of all kinds, and of prolapse of the rectum.

We endeavor to restrict these dangers through amelioration of the cough.

An old established remedy is,

Rp. Chinin. sulfuricum, 0.05–0.07 in the first year.
0.07–0.15 in the second and third years.
0.15–0.25 from the fourth year on.
Three powders daily (Neurath).

or aristochin, three times a day as many decigrams as the child has years, or as many centigrams as it has months, the maximum dose being 1.2 gm. per diem (Neurath). After several days of the treatment it is advisable to make a pause of several days. Good results are seen in older children from belladonna preparations; for instance, in children over five years, atropin sulphate, 0.0002 : 100; 1 teaspoonful (care!) in the morning and night, or tinctura belladonnæ, gutt. ii to v in a day.

Further, bromoform, 0.5 to 1 gm. three times a day; tussol (bitter almond antipyrin) from 0.15 to 1 gm. in a day; pertussin, 3 teaspoonfuls daily (fluid extract from the German thymea with sugar syrup); oxycamphor, 0.1 gm. three times a day for a year; citrophen, 0.1 gm. three times a day for one year.

Pyrenol is also warmly recommended. It is the sodium salt of benzoic acid thymylester and benzoyl-salicylic acid, and is given in doses of 1/2 to 1 teaspoonful daily of the 1 to 2 per cent. solution (K. Gauze), or in following manner:

Rp.	Pyrenol,	1.0–4.0
	Liq. ammon. anis.,	3.0
	Aq. destill. ad.,	100.0
DS.		

Of the innumerable inhaliaton remedies recommended, Vaporin (naphthen-eucalypto-camphora) may be mentioned, of which a tablespoonful is placed in boiling water. Also 2 per cent. carbolic acid and other antizymotics are much in use.

Tuberculosis of the Bronchial Glands.—External application of antitussin (difluordiphenyl) and insufflation into the larynx (sulphurate of quinin) have been tried.

If we see attacks resembling pertussis which must be related to tubercular bronchial glands, we have first to keep in mind the general treatment; also we may employ with advantage iodin in various forms, and rubbing of the thorax with soft soap.

Rp.	Ferri jodat. sachar.,	0.15–0.5
	Sachar. lactis,	4.0
	Div. in dos. Nr. X.	
DS.	Two powders daily.	
Rp.	Sirup. Ferri jodat	
	To 2 years,	1–2 gtt. *pro dosi.*
	2 to 5 years,	3–10 gtt. *pro dosi.*
	5 to 10 years,	10–15 gtt. *pro dosi.*
	10 to 15 years,	15–20 gtt. *pro dosi*
	(Seifert.)	

Nervous Cough.—If the cough is of central origin or incited from the region of distant nerves, we have then, under no condition, to consider it as a useful reflex. We should proceed against the irritation to cough according to the nature of the illness.

In hysteria a suggestive treatment, as, for instance, faradization of the larynx, is often accompanied by instantaneous results. In neurasthenia and chorea minor, the treatment of the primary disease usually suffices for the complete relief of the cough, except if a reflex nervous irritation is present.

Also a foreign body in the external auditory passage, a disease of

the adnexa, or a displacement of the uterus may lead to cough, lasting for years.

In these cases one must unite the removal or treatment respectively of the cause with the general treatment, and eventually combine it with suggestion.

Some form of nervous cough may prove at times especially disturbing.

In sensitive children the insertion or removal of the tracheal cannula is followed by incessant coughing, and for this reason the success of the *decanulement* even may become questionable. In such cases some sedative medicament is indicated before the removal of the cannula.

Cough on Drinking.—If cough occurs on taking food, especially on drinking, it signifies an insufficient closure of the glottis, whether a tubercular infiltration disturbs the act of the closure, or postdiphtheritic paralysis exists, or the reflex irritability is sunken very low.

The symptom itself always calls for energetic treatment. One first tries giving only soft food, avoiding all liquids, especially milk. If this does not succeed, one must prescribe a special diet. For symptoms of paralysis, electricity, strychnin injections, etc., are indicated.

CHAPTER VI

THE SPUTUM

Importance of the Examination of the Sputum.—Of great importance for the treatment of diseases accompanied by cough is the examination of the sputum. In no case of importance may it be omitted. With the rise of chemistry and bacteriology as scientific helps to medicine, the thorough macroscopic examination of sputum has been forced into the background, but unjustly.

The spreading out of the sputum with preparation needles and its careful inspection in direct and transmitted light, should precede the microscopic and bacteriological examination in every case, since it may furnish the most important points for diagnosis and treatment.

ABSENCE OF EXPECTORATION

In children, marantic old people, and in exhausting diseases, the sputum cannot be collected, since it is swallowed. If it is absent in diseases usually accompanied by expectoration, one may presuppose that the secretion is very sparing and tough, an assumption which may be controlled by physical examination.

COLLECTION OF SPUTUM IN YOUNG CHILDREN

If a sputum examination is desirable in young children who do not expectorate, it is advisable to insert a cotton swab as far as the aditus ad laryngem in order to induce cough, and to collect the balls of secretion thus brought up. It has also been proposed after a very loose ringing cough to wash out the stomach in the morning before breakfast, in order to obtain the secretion which has been swallowed.

GROSS MACROSCOPICAL EXAMINATION OF THE SPUTUM

A careful sputum examination demands a twenty-four-hour specimen.

Amount.—One must first determine the amount. Very copious expectoration occurs in abundant hemorrhage, in edema of the lung, as well as in the breaking of a suppurating focus into the bronchi (empyema of the thorax, subphrenic abscess, etc.), in cavities of tubercular or bronchiectatic origin, in lung abscesses, and in broncho-blennorrhea (Fraentzel).

Under certain conditions the amount of expectoration changes with the position assumed by the patient, depending on the relation of the point of exit of the fluid to its level.

We wish to emphasize that so profuse a secretion works exhaustingly in itself from loss of body substance, but chiefly from the incessant cough. Still, blocking the secretion by assuming certain positions of the body is detrimental, and may lead to resorption fever and often to dyspnea.

Consistency.—Some sputa are so thick that they will not flow from the spittoon, as the sputum in the height of croupous pneumonia, usually that in asthmatic patients, and in the first stage of acute bronchitis (sputum crudum).

In the further course of bronchitis the sputum becomes very purulent (sputum coctum) and flows readily, as in abscess of the lungs, gangrene of the lung, putrid bronchitis, and opening of pus sacks into the bronchi.

Stratification of the Sputum.—Sputum is homogeneous in its composition only so long as it consists of one mass; thus of mucus, of pus or of serous transudates in edema of the lungs; when, however, it is composed of two ingredients, as pus and mucus, it changes to another consistency, often very characteristic. Profuse purulent secretion mixed with mucus leads to the formation of three layers, as may be observed in bronchiectasis, and, above all, in putrid bronchitis and gangrene of the lungs.

Nummular Sputum.—Balls of pus, embedded in a little mucus, form the coin-like sputum. It speaks for a not very intimate mixing of pus and mucus something that may be expected when pus issues from cavities. The air content of the sputum is small in such cases. If suspended in water it rapidly sinks to the bottom (sputa fundus petentia).

Thread-like Sputum.—A narrow communication of a cavity or of a pus pocket with the bronchus leads to a corresponding configuration of the pus (similar to the form of the stools in intestinal constriction), giving it a very characteristic finely floccular appearance (A. Fraentzel).

Color and Transparency.—The color of the sputum depends on the chemical composition and microscopical structure (v. Jaksch). Mucus is almost colorless and transparent; serous expectoration transparent, but the color of broth; cellular elements, especially pus cells, cause cloudiness and a whitish color, becoming yellow or greenish in mass.

Through mixture of blood the changes of the sputum become numerous. These will be more closely studied in the chapter on hemorrhages. Here a few remarkable transformations of the blood coloring matter may be mentioned.

Occasionally the expectoration in lung abscess and gangrene is of a brownish tint (v. Leyden). v. Leyden traced these colors back to the hematoidin crystals already known to Traube, and determined their presence also in communications with the gall passages, in which case the color of the sputum was ocher yellow (bilirubin crystals).

The rusty sedimentation in the sputum of patients with heart disease or with increased pressure in the pulmonary circuit is well known. The rust-colored sputum of croupous pneumonia is pathognomonic, while green sputum occurs in delayed resolution of genuine pneumonia, in pneumonia with icterus, in abscess formation, and in subacute caseous pneumonia (Frantzel). The black color as a result of mixture with soot is of little significance; the same may be said of a green or yellow color from bacterial pigmentation.

Odor.—The odor is characteristic only in putrid bronchitis and gangrene; in these cases it is often of the greatest diagnostic importance.

CLOSE INSPECTION OF THE SPUTUM

We pass now to the careful spreading out and inspection of the sputum on white and black backgrounds. We find occasionally:

Spirals.—Spirals are forms which v. Leyden found in asthmatic patients, and which Curschmann always connected with bronchiolitis. They have been found by different observers also in pneumonia. In existing asthmatic attacks their presence speaks strongly for the diagnosis of true bronchial asthma (v. Jaksch).

Fibrin Clots.—According to A. Schmidt, fibrin clots are occasionally found in asthma; also in croupous pneumonia, in descending diphtheria, and, above all, in idiopathic fibrinous bronchitis with chronic course where veritable molds of the bronchi are sometimes expelled.

In rare cases the inhalation of irritating gases, as ammonia, or the internal use of iodin leads to formation of fibrin clots (Fritzsche.)

Cheesy Particles.—The finding of cheesy fragments in purulent sputum, the size of a millet grain or poppy seed, and of a yellowish-white color is ominous. One usually finds large numbers of tubercle bacilli in them.

Dittrich's Plugs.—Similar, but usually larger, and of bad odor are the putrid plugs described by Dittrich and Traube. They occur in putrid bronchitis and in gangrene of the lungs and consist of detritus, crystals of margaric acid and bacteria, with a varying quantity of leukocytes.

Shreds of Lung Parenchyma.—The two diseases are to be differentiated by means of the sputum examination. Gangrene often allows

shreds of the parenchyma of the lung to be seen; putrid bronchitis never.

Pieces of Cartilage.—They are found in lung abscess and more rarely in cascous pneumonia. In ulcerating processes with perichondritis of the upper air passages, sequestrated pieces of cartilage may be expectorated.

Foreign bodies, lung stones, and echinococcus membranes occur so seldom in the sputum that we are satisfied only to have touched upon their occurrence.

MICROSCOPIC EXAMINATION OF SPUTUM

The microscopic examination of the sputum controls and completes the results of the macroscopic.

One notes red and white blood-corpuscles; among the latter eosinophiles; farther, epithelial cells of all kinds, myelin drops and elastic fibers. Only these last are of diagnostic value. They occur in tuberculosis, ulcerating bronchiectasis, abscess, and only rarely in gangrene.

It is a remarkable fact that O. Vierordt and v. Jaksch have found them in pneumonia, without clinical termination in lung abscess being noted.

Since elastic fibers of the food may be mixed with the sputum, only those found in characteristic arrangement are of real diagnostic importance.

Asthma Crystals.—One finds the crystals of Charcot and Leyden if one allows the sputum collected at the beginning of a bronchial asthmatic attack to stand twenty-four to forty-eight hours, or in sputum collected later in the attack. They are not diagnostic but are almost never absent in asthmatic patients, and are only seldom found in other diseases, as acute bronchitis, chronic croupous bronchitis and tuberculosis (v. Vierordt).

Hematoidin Crystals.—The finding of red rhombic columns, needles, or conglomerates without definite crystal form, points to a previous hemoptysis, infarct, or pus focus; indeed, intracellular hematoidin crystals speak rather for hemorrhage, free crystals for a perforated abscess (v. Jaksch).

Bacilli in the Sputum.—The finding of influenza bacilli, pneumococci, the bacilli of tuberculosis and diphtheria, micrococcus catarrhalis, plague bacilli, actinomyces and pathogenic molds is, under certain conditions, of great importance for diagnosis, prognosis, and treatment.

Prognostic Significance of Tubercle Bacilli.—In regard to the prognostic significance of finding tubercle bacilli: the most severe cases

of phthisis may show no bacilli in the sputum. In acute miliary tuberculosis bacilli are almost constantly absent, if at the same time an old ulcerative process does not exist locally. The number of bacilli found in the sputum is no measure of the severity of the disease. However, it must be considered as a favorable symptom if bacilli, having been abundant earlier, become continually scarcer and finally disappear entirely (Turban).

Mixed Infection in Tuberculosis.—Nests of tubercle bacilli and masses of cocci (strepto-staphylococci, micrococcus tetragenus) are a very unfavorable sign, as an expression of mixed infection which produces the picture of true pulmonary consumption.

Mixed Infection with Influenza.—Mixed infection with influenza bacilli are frequently found in measles, pertussis, and diphtheria; the course of these diseases becomes thereby more severe, showing a tendency to the appearance of lobular foci.

CHEMICAL EXAMINATION

The chemical examination of the sputum will only be touched upon here, as it is not of much value for the clinic. Two factors important for differential diagnosis will be mentioned. The sputum of putrid bronchitis and of pulmonary gangrene becomes acid very quickly, whereas otherwise sputum constantly shows an alkaline reaction.

The albuminous expectoration in pulmonary edema can be distinguished from that due to the breaking through of a serous pleural exudate, by the greatly inferior amount of albumin shown on boiling (Sahli).

THERAPEUTIC INDICATIONS RESULTING FROM SPUTUM EXAMINATION

Sputum examination often indirectly influences our therapeutical measures, furnishing a valuable aid for diagnosis. Here we shall speak only of that treatment which purely symptomatically rests on the nature of the sputum, without considering the etiological factor.

Scanty, Tenacious Secretion.—In all respiratory diseases with scanty, tenacious sputum, our first aim will be to ameliorate the disorders of respiration and of cardiac activity as much as possible. In chronic diseases it is of great importance to avoid any excessive deposit of fat, and to institute, if necessary, a slow and careful antifat treatment.

Climatic treatment plays a great part: during the cold period of the year patients should go to a warmer climate on the sea; in the summer the northern sea baths and sea voyages may be of advantage.

The treatment by mineral waters in watering-places may give great relief and improvement. If a sojourn in such places is not feasible, alkaline or alkaline muriatic or sulphuric waters may be drunk at home, pure or mixed with hot milk. The air in the rooms should be constantly kept humid by means of water evaporation.

Sodium iodid, in doses of 2 gm. *pro die* seems to have a favorable action in some cases. Some authors, as Ortner, conclude, however, that these were cases of catarrhal asthma and not simple bronchial catarrhs. The administration of flowers of sulphur, about 1 to 2 gm., taken every morning in milk, has been recommended. It is supposed to be excreted through the bronchial mucous membrane in traces in the form of H_2S, producing in this way an increased flow of blood and thus an increased secretion.

The treatment in the pneumatic chambers may give very good results. There exist transportable apparatus which may be used at home, permitting of the inspiration of condensed air and the expiration into thin air.

A very important indication is support and improvement of the cardiac force, which may be obtained by the same measures employed in the treatment of chronic insufficiency of the cardiac muscle. If the discomfort is severe, narcotics, as opium, morphin, codein, etc., will be, for a time at least, indispensable.

A calming tea of the following formula may be given for a change:

Rp. Fol. belladonna.,
Fol. altheæ.,
Herb. lichen island,
Stipit dulcamar. āā 30.0
MDS. 1 tablespoonful to 1 cup of tea.
2 cups daily.

Too Copious Expectoration.—If great quantities of sputum are expectorated, the use of sedatives is contraindicated. Otherwise putrid decomposition of the secretion may be brought about within the lungs, leading to danger to the patient and to torture for him and for those about him.

Only on rupture of an empyema into the bronchi will a slow evacuation of the purulent masses be indicated, if necessary with the aid of narcotics, since in these cases an imminent danger exists that the whole bronchial tree may become inundated with pus.

In other cases we have to aim to get rid of the secretion already formed and to prevent its further formation.

In puriform bronchorrhea of long standing the patients go into a decline, leading, not infrequently, to general amyloid degeneration (v. Jürgensen).

Though it is questionable if these dangers may be removed by overnutrition, abundant nourishment, especially food rich in nitrogen and of high calorific value, meat, milk, butter, will be advisable.

The common expectorants are but little used in chronic cases; C. Gerhardt warmly recommends mechanical compression of the thorax, either by the hand or by means of the respiration chair.

Of the internal remedies decreasing secretion, the ethereal oils are very frequently used. Much in favor is the rectified oil of turpentine, given in capsules containing 20 drops, once or twice a day. Milk should be drunk immediately, as otherwise gastric disturbances may arise. On too prolonged use of this drug, irritation of the kidneys may develop or an exacerbation of a chronic nephritis. Oil of turpentine may be inhaled with good results as an aid to its internal administration (Niemeyer's turpentine pipe). Substitutes for turpentine are turpentine hydrate (3 gm. *pro die*) and terpinol (0.3 *pro die*).

Rp. Terpinhydrat, 1.0
Spir. vin. dil.,
Aq. menth. piper.,
Syrup. rub. idæi, āā 50.0
DS. One tablespoonful three to six times a day.

Rp. Terpinol, 3.0
Pulv. et extr. liquiritiæ, q. s.
ut. f. pilulæ Nr. XXX.
DS. Four to six pills daily.

The balsams (balsam of Peru, tolu, and copaiba) may be dispensed with, and are to be avoided especially in irritable stomach.

Liebermeister emphasizes the use of myrrh in the following prescription:

Rp. Ferr. sulfur. pur., 1.25
Kali carbon. pur., 1.5
Aq. menth. crisp., 250.0
Adde: myrrh pulv.
antea cum sacchar 15.0 contrit.
MDS. One tablespoonful four times a day.

Carbonate of guaiacol, up to 5 gm. *pro die*, has been recommended in order to restrict the secretion. It is nonirritating to the intestinal mucous membranes, and therefore may be used also in children. Children receive 1/2 gm. daily, or 1 teaspoonful to 1 tablespoonful of syrupus picis liquidæ three times a day (Feer).

For profuse secretion a dry climate will be preferable, as Helouan, in Egypt, Arizona or a high mountain climate as St. Moritz, in Switzerland, at winter time.

Biermer has warmly recommended the use of mineral waters containing calcium sulphate (Weissenburg, in Switzerland). Calcium salts may also be given in the form of Aq. calcis, 1 tablespoonful every two hours.

Decomposed Secretion.—If the secretion has become decomposed it is absolutely necessary to secure expectoration, to avoid narcotics, and to use antiseptics. Oil of turpentine may often bring about recovery even in the most severe cases. (v. Jürgensen.)

Myrtol has been recommended by Eichhorst in gelatin capsules of 0.015 gm., 2 to 3 capsules every two hours. Inhalations of 1 per cent. carbolic acid may be carefully used (attention to the urine!).

Fibrin Clots.—The appearance of fibrin clots in the sputum is not pathognomonic for any special disease. In any case it is advisable to have the patient breathe warm vapors of water and by means of a spray to apply aqua calcis, in which fibrin dissolves, though slowly.

The medicinal treatment (sodium iodid, creosote, belladonna preparations, mercurial ointment) is often entirely fruitless.

Admixture of Blood.—Admixture of blood in the sputum is of greatest importance in regard to treatment, though the diagnosis of the primary disease is not influenced by it. In the chapter on Hemorrhage we shall speak further of this symptom.

CHAPTER VII

VOMITING

GENERAL REMARKS

Vomiting is the expulsion of the stomach contents through the esophagus and mouth, whether directly from the stomach or indirectly, passing through the stomach from the intestines. The contents of the stomach may be normal or pathologically changed by different morbid processes (inflammations, intoxications, hemorrhages, ulcerations, neoplasms, cardial and pyloric stenoses). The immediate cause of the vomiting is the increase of pressure in the stomach, due to increased abdominal pressure and simultaneous opening of the cardia.

It is a frequent symptom of the most various diseases, its significance being dependent on the nature of these diseases.

The center for vomiting lies in the medulla oblongata, not far from the center for respiration and cough. The irritation of this center, which may be brought about directly (*i.e.*, apomorphin) or reflexly, or from the cerebral cortex, results in the act of vomiting. The reflex arc is formed by the sensory branches of the phrenic, vagus, and sympathetic nerves and by the motor branches of the glossopharyngeal, vagus, phrenic, and sympathetic; also the splanchnic nerves are supposed to have some part in it. Through the interaction of all these nervous organs the complex movements of swallowing, retching, breathing, and pressing is brought about, which results in vomiting. On experimental section of both vagi the act of vomiting is markedly inhibited.

In acute affections of the stomach (intoxications, dyspepsia) vomiting is an act of self-defense on the part of the organism. In laryngeal croup and in foreign bodies in the aerial passages or in the upper part of the digestive tract, a favorable change may be brought about through vomiting. In pyloric and duodenal stenosis it has the advantage of removing remains of food, which otherwise would become decomposed, but owing to complete expulsion of the food it often renders nutrition difficult. In all other cases it is of decided disadvantage; indeed from its frequency alone it may become dangerous—if after each intake of food everything is vomited the danger of inanition becomes imminent. The violent movements of the vomiting sometimes cause the rupture of a blood-vessel in individuals with the necessary predisposition from the sudden excessive increase of blood

pressure. Fresh peritoneal adhesions may break, circumscribed abscesses and intestinal ulcers may perforate into the free abdominal cavity, and an invagination or volvulus may become more critical.

Vomiting is further an initial symptom worthy of serious consideration in certain severe affections, as diseases of the brain, of the meninges, and of the peritoneum.

We distinguish two great groups of affections leading to vomiting:

I. The reflex is set in action from the intestinal tract or from the other abdominal organs (reflex vomiting).

II. The center for vomiting itself is irritated by some stimulus or this stimulus is transmitted to it from the cerebral cortex (central vomiting). We distinguish the following subdivisions:

1. Cerebral vomiting.
2. Spinal vomiting.
3. Toxic vomiting.
4. Nervous vomiting.
5. Periodic vomiting.
6. Habitual vomiting.

I. REFLEX VOMITING

In the first place, there may be mentioned those diseases of the esophagus in which, though the act is produced, the food is not brought up from the stomach, but is retched up from the esophagus before it has reached the stomach. This vomiting usually follows immediately upon the intake of food. The best example of this is stenosis of the esophagus, which may lead to a dilatation above the stricture. Here, however, the food may remain even for hours. It is usually expelled, together with a great quantity of tenacious, thread-like mucus, the product of the catarrhal inflammation of the mucous membrane.

Stenosis of the esophagus may be caused by a neoplasm of the esophageal wall, by a cicatricial constriction (following cauterization from lye, following lues, tuberculosis, peptic ulcer of the esophagus) or by a compression from without, from tumors, aneurysms, or a filled diverticulum of the esophagus. The vomited matter in these cases always appears entirely unchanged, not containing HCl, digestive ferments, or biliary pigments.

Examination of Vomited Matter.—In many cases, if the patient is unable to furnish us anamnestic data, we have no other resource in reaching an opinion than microscopical and chemical examination of the vomitus.

The quantity, color, composition, and odor are important for the diagnosis. Remains of undigested food, mucus, blood, bile, can with

some practice be recognized with the naked eye. In the presence of mucus and large quantities of the peptic products of proteins the filtration proceeds only slowly, and the filtrate is a yellowish opalescent liquid. Examinations for free HCl and lactic acid are now made with the well-known qualitative tests, followed by the quantitative determination of total acidity, of free HCl, and of the total HCl. If the vomited matter is not at our disposal, a very careful anamnesis should at least be obtained.

Anamnesis.—This should refer, as much as possible, to the vomited matter, to its quantity, aspect, odor, and taste. We have, further, to investigate which symptoms preceded the vomiting, if it appeared on an empty stomach or after the intake of food, and, if the latter, how long after it; how the act of vomiting proceeded; whether previously existing pain had in some way been influenced by it; and what was the feeling of the patient after the vomiting.

Stenosis of the Esophagus.—The nature of the ingesta vomited from the esophagus is the same in functional neurosis, as in anatomical stricture. The diagnosis of a spastic stenosis of the esophagus is, if possible, to be verified by X-ray examination, esophagoscopy, or at any rate by examination with sounds. The anamnesis, too, gives very valuable points. In neuroses fluids are more difficultly swallowed than firm masses, which sometimes pass without trouble and pain and are retained in the stomach. The great irregularity in the severity of the discomfort also speaks for esophageal spasm, though it must be conceded that even in the course of a cancer of the esophagus remarkable improvements may sometimes be observed from ulceration of the tumor.

Very characteristic for the spastic stenosis is the examination with sounds. The sound first sticks at a certain point, and then after a few minutes suddenly passes readily into the stomach.

Before the sound is passed one must be sure that no aortic aneurysm is present producing stenosis of the esophagus by compression. If in this case the bougie is passed carelessly and with force, the wall of the aneurysm may be perforated, resulting in a fatal hemorrhage. All other symptoms of aneurysm, as heart findings, pulsations above the sternum, auscultation over the suspected area, pains radiating into the arms, and paresis of the recurrent nerve, have therefore to be carefully looked for, and, if possible, a radiological examination should be performed.

The treatment of the anatomical stenosis of the esophagus is entirely surgical, that of the functional disorder psychical and suggestive.

Diseases of the Stomach.—Vomiting is a frequent symptom in many diseases of the stomach. It is found, with other manifestations

of dyspepsia, in acute catarrh of the stomach; at first it is easy, and later on when the stomach is empty it becomes more difficult and painful. If the expulsion follows quickly on the intake of food, the vomited matter contains remains of food in an undigested state, mixed with an abundant quantity of mucus. Its odor is sometimes rancid and sour, more rarely insipid, and its taste acid and bitter. In frequent vomiting, a considerable amount of bile is sometimes found in the vomitus.

The chemical examination shows a decreased amount of free HCl. The microscopical examination sometimes sarcinæ, yeast, or oidia. In general, however, the bacteriological examination of the stomach furnishes only little help for the differential diagnosis. Mycotic gastritis, in the narrower sense (dysentery, diphtheria, etc.), is certainly very rare, however frequent a secondary involvement of the stomach may be in most infectious diseases (measles, pneumonia, variola, erysipelas, etc.). Vomiting may become very agonizing in the toxic and phlegmonous forms of gastritis.

In intoxication with strongly irritating and caustic poisons vomiting is very violent and associated with intense pain in the region of the stomach, increasing after every act of vomiting. Finally, an outbreak of cold sweat, livid discoloration of the general integument, and small pulse and collapse appear.

In indigestion and the resulting acute catarrh of the stomach the vomiting should not be combated at first, as it causes the elimination of harmful substances from the body; if it ceases too early and the subjective discomfort persists, the stomach may be washed out to empty it completely, but under no condition should an emetic be given. If the vomiting persists after complete emptying of the stomach, it will then be time to combat it.

Small fragments of ice may be swallowed, a hot-water bottle or thermophore applied to the region of the stomach, or, better still, Leiter's coil through which hot water is passed.

If these measures prove fruitless, the vomiting may be promptly checked by a morphin injection; it is advisable, however, to inform ourselves beforehand, whether morphin produces vomiting in the patient. Sometimes the desired result may be brought about by cocain in doses of 0.03 gm. in watery solution.

Rp. Menthol,, 0.5
Sacchar. 4 } *pro dosi*

or

Anæsthesin, .75 gm. *pro dosi.*

Also cerium oxalicum, usually in doses of 0.1 to 0.2 gm. three times a day, may be given, up to a daily dose of 1 gm.

In intoxications the washing out of the stomach should be done as soon as possible and continued until no poison can be detected chemically in the water pumped out. Only in strong caustic poisons should the use of the stomach-pump be avoided, as perforation resulting in peritonitis may easily be produced.

In chronic gastritis, nausea is very frequent, either in the morning on an empty stomach or at the height of digestion; but only persons who vomit easily can expel the ingesta, which often have undergone putrefaction and fermentation owing to the disturbed chemism and the retarded motility. They contain considerable amounts of saliva and mucus. The mucus is glassy, tenacious, and usually adheres to the walls of the vessel. It has, of course, pathognomonic value only if it has been produced in the stomach, and must therefore be well distinguished from swallowed mucus, whose origin in the bronchi may be recognized by pigmented alveolar epithelial cells or, in case of the mouth or pharynx, by the pavement epithelium.

The amount of free HCl varies, being usually less than normal. Boas, Riegel, and others, however, believe firmly in the existence of an "acid catarrh" which is to be differentiated from chronic hyperchlorhydria by the superabundance of mucus. In this form, pyrosis—sour eructations with pain in the esophagus and cardia—is frequently observed, as in hypersecretion.

In advanced cases leading to atrophy of the gastric glands free HCl is entirely absent and the pepsin and rennin ferments are considerably decreased.

In the chronic gastritis of alcoholics vomiting usually occurs in the morning on empty stomach, especially on washing out the mouth; the same is true in nervous individuals with chronic pharyngitis. We observed a nervous woman suffering from gastric atony who vomited every morning on brushing her teeth; on being advised to perform the cleansing of the teeth at another hour the vomiting ceased. With the improvement of the gastric and pharyngeal catarrh, respectively, the vomiting will disappear without any special therapy.

Vomiting is an important symptom in dilatation of the stomach, due to stenosis of the pylorus The quantity of the vomitus in advanced cases is, corresponding to the great capacity of the stomach, very large. Through retention of the stomach contents larger quantities of ingesta are often vomited than would be in accord with the last meal taken. Remains of food taken many days before are often found. The ingesta are of rancid odor and taste, and on short standing three layers may be distinguished: an upper one, consisting of a brownish foam; a larger middle one, composed of a yellowish-brown, slightly opaque liquid, and a lower one, consisting of

crumbly and mucoid dark brown masses, chiefly food remains. The rising of gas bubbles similar to the pearls in a champagne glass in which bread particles have been dropped may be observed (Ewald).

The total acidity is usually increased, owing sometimes to hyperchlorhydria, but usually to abnormal quantities of organic acids. Gases, as H_2S, are produced from the processes of fermentation of proteins, and this, according to Boas, speaks for the benign form of ventricular ectasia and against carcinoma.

In dilatation of the stomach due to cancer of the pylorus the microscopical examination of the stomach contents shows numerous muscle fibers, with their transverse striations well preserved, and in simultaneously existing hyperchlorhydria undigested starch particles.

An enormously developed flora of saccharomycetes and schizomycetes is a constant finding. Sarcinæ speak against cancer. In these cases vomiting does not occur on an empty stomach; it is dependent on the intake of food, and occurs the less frequently the smaller the residuum remaining in the stomach after each meal.

Vomiting may be entirely absent, even in cicatricial stenosis of the pylorus, if the patient does not take food until all remains of the previous feeding have disappeared from the stomach (Bouveret).

The expulsion of stagnant masses occurs sometimes in one act, giving rise to a sensation of well-being at once; in other cases the feeling of fulness and nausea disappear only after repeated vomiting.

In atonic ectasia of the stomach as well as in the dilatation due to stenosis of the pylorus vomiting may be observed.

Removal of the gastric contents followed by lavage of the stomach is the best method of treating the vomiting in dilatation.

Stomach Lavage.—To wash out the stomach we use preferably the tube introduced by Oser, made of mineralized rubber, and rounded off at both ends; or a soft, elastic stomach catheter with a blind lower end, having lateral openings. It is connected with another rubber tube by means of a short glass tube, in the end of which a large glass funnel may be attached. The rubber tube should have two marks: one at 40 and another at 60 cm. from its lower end. The patient, sitting on a wooden stool, is asked to hold his head erect, not to bend backward, and to breathe quietly. The tube is moistened with water before introduction, then held short, like a writing pen; it is pushed straight down along the posterior wall of the pharynx. The patient is now asked to swallow and at the same time the tube is slowly pushed downward. During the whole procedure the patient has to be asked repeatedly to breathe deeply and quietly. If the patient becomes cyanotic the tube has to be removed at once. The distance from the teeth to the cardia is 40 cm. and when the first

mark is past the teeth, the tube is in the stomach. The size of the patient and the dilatation of the stomach will be important factors in determining how far the tube is to be inserted.

The funnel is now lowered and the patient is asked to strain as in defecation. When no more stomach contents are expressed, the lowered funnel is filled with water, then raised, and all the water in it, except that one inch above its opening, is allowed to flow into the stomach; the funnel, in order to siphon out the water and the remaining ingesta, is then quickly lowered. If the flow stops, the cause may lie in obstruction of the openings of the tubes or in the fact that its lower end does not dip sufficiently below the level of the liquid. In the latter case, if the tube be pushed a little forward, the flow begins again. Obstruction of the tube or of its openings may easily be removed by pouring water through it. An air-bag without a valve is of good service in such cases. If this is to be used for aspiration, too, the tube is pinched tightly on the side toward the patient's mouth with two fingers of one hand, the balloon, compressed with the other hand, is then inserted on the distal end of the tube; the fingers are then removed from the tube, and the dilating balloon aspirates the stomach contents by suction. The washing is continued until the rinsing water runs clear. If the patient now changes his position from sitting to lying, particles of food may still be pumped out. In hour-glass stomach, a considerable amount of stomach content may appear after the organ has seemed entirely empty (W. Zweig). On removing the tube the funnel must be held high, allowing the water in the tube to run into the stomach; thus, one will avoid producing a lesion of that portion of the stomach membrane lying against the openings of the sound. The stomach is usually washed out once a day, on empty stomach, before the chief meal or in the evening. Most authors prefer the last-mentioned time, which, according to Riegel, has the advantage of giving the stomach a longer rest. Boas prefers it, because processes of fermentation and decomposition are prevented during the night, but he states rightly, that the organism is thereby deprived of a certain amount of food. Oser recommends the performing of lavage before the chief meal. In general the best time for it will be when the patient has the greatest discomfort. Water of 32° C. usually serves as the rinsing material. Hoffman prefers physiological salt solution. If necessary, antifermentative and antiseptic drugs may be added, which, however, can be only considered as a small aid to the much more important mechanical cleansing.

The following concentrations may be used (Penzoldt):

Boric acid, 2 to 3 per cent.

Resorcin, 2 per cent.

Chloroform water, 0.5 per cent.

Thymol, 0.5 per cent.

Hydrochloric acid, 0.2 per cent.

Bicarbonate of soda, 1 per cent.

Also 1 teaspoonful of Carlsbad salt to 1 liter of water, or Carlsbad or Vichy water.

In chronic hypersecretion, silver nitrate in a solution of 1 : 1000 may be used as rinsing material; to exclude any irritating effect afterward 100 gm. of a 1 per cent. salt solution may be drunk; or, instead of silver nitrate, protargol in a 1/2 per cent. solution may be tried (W. Zweig).

The technique of stomach lavage in infants, as first recommended by Epstein, may be mentioned here.

The apparatus is the same as for adults, only the stomach-tube may be replaced by a Nélaton catheter, with an inside diameter of 6 mm., the funnel should be smaller (containing 50 c.c.), and the tube shorter (about 50 cm.).

The mother sits down and holds the child on her lap, with its arms wrapped in the blanket. The mother places her left leg on the stool, her right on the floor, and holds the child with its head on her right leg and its feet on her left. The child lies in the right lateral position with the face turned to the floor. The physician sits opposite the mother and introduces the tube with his right hand.

In the beginning the child strains a great deal, becoming somewhat cyanotic, but later on it begins to cry, and the tube may then be quietly pushed farther down. If the child strains again while it is crying, the outflow may stop through the forcible rise of the intra-abdominal pressure. The lavage must be continued until the rinsing water flows clear. It is not possible usually to regain the total quantity of water introduced; therefore, one must be careful in adding antiseptics.

A 0.4 per cent. solution of resorcin may be used without hesitation, as well as boric acid in 3 per cent. solution or half a teaspoonful of Carlsbad salt in 1 liter of water.

We may now return to the discussion of the indications and contraindications for stomach lavage.

In stagnation, with danger of abnormal decomposition processes, it is indicated; it is to be avoided in uncompensated heart lesions, fatty heart, arteriosclerosis, aortic aneurysm, hemorrhage of the stomach, and peritonitis.

The round ulcer of the stomach may lead to vomiting. The exposed nerves become irritated by the food, an attack of pain is brought about, and, reflexly, vomiting. If the ulcer lies near the pylorus, its cramp-like closure or the cicatricial constriction of the healed ulcer may produce symptoms of pylorus stenosis, and lead

secondarily to dilatation of the stomach, the stagnation of the food causing the vomiting. The vomitus consists of slightly changed particles of food or, if the interval elapsing since the last meal is a long one, of a watery fluid of strongly acid odor and taste and of acid reaction. One finds, besides, a little mucus and perhaps a few streaks of blood. The amount of free acid may be normal or increased.

If the peptic ulcer is localized in the duodenum, vomiting and attacks of pain appear about three to four hours after the meal. Sometimes bile-tinged, acid masses are expelled.

Hematemesis.—Hematemesis may be mentioned here, though it is taken up again in the chapter on hemorrhage. Hematemesis may be the first symptom of a latent ulcer of the stomach. Usually, however, it is preceded by discomfort. Only in a very violent expulsion of blood is the color of the vomited blood unchanged; usually through the action of the acid gastric juice it shows a dark red-brown color, or a coffee-ground appearance, and it may even coagulate in the stomach.

Beside the peptic ulcer, many other affections may lead to bloody vomiting, as cancer of the stomach, cirrhosis of the liver, and all other processes causing stasis in the portal circulation; farther, the hemorrhagic diathesis, like scurvy, the acute yellow atrophy of the liver, and diseases of the gastric vessels, as arteriosclerosis, which, through peptic ulcer, but also without it, may lead to bleeding varices of the gastric veins, as in liver cirrhosis; finally trauma in the region of the stomach, and caustic poisons.

Confusion with epistaxis during sleep whereby the blood flows backward into the pharynx, with hemorrhage from pharyngeal and esophageal varices, and finally with hemoptysis, is possible, but may almost constantly be avoided on careful examination.

Hematemesis is a very dangerous symptom which sometimes leads directly to death. According to Brunton the mortality is 3 to 5 per cent. of all cases, and of these about four times as many men die as women. Hematemesis is sometimes preceded by a peculiar euphoria, with the cessation of pain. This, perhaps, may be explained by the sedative effect of small previous hemorrhages, which, like local bleedings, cause a diminution of the inflammatory processes around the ulcer.

The demonstration of blood in the vomited matter is sometimes possible through the microscope; otherwise one must make use of Heller's test, the turpentine-guaiac reaction, the hemin test, or the spectroscopic examination. The sensitiveness of Weber's test is very remarkable, showing blood coloring matter even from small rests of meat in the stomach.

The treatment of hematemesis consists in absolute rest in bed, complete abstinence from food, eventually morphin injections, and

the application of cold to the gastric region. A 10 per cent. sterilized solution of gelatin may be given in doses of 1 tablespoonful hourly. Adrenalin (Takamine), suprarenin (Merck) and tonogen (Richter) may be tried subcutaneously as well as internally (10 drops of a 1:1000 solution, three times daily); farther, a subcutaneous injection of gelatin, but only Merck's preparation, should be used, as this furnishes us the guarantee against tetanus infection.

In some cases, immediate laparotomy must be considered.

More rarely than in ulcer of the stomach, marked hematemesis is observed in the peptic ulcer of the duodenum, and in cancer of the stomach, though in rare cases of the latter affection violent hematemesis may occur. In duodenal ulcer the effused blood is not vomited, usually, but evacuated by the bowels.

The vomiting of chocolate-like masses sometimes occurs in cancer of the stomach. Such "coffee-ground" vomiting is found in every case of gastric hemorrhage, when the act of vomiting only follows some time after the hemorrhage. Whether subjects of cancer of the stomach suffer from frequent vomiting depends on the seat of the tumor. Cancer of the cardia behaves, in this regard, like an esophageal stenosis; cancer of the pyloric end like ectasia of the stomach, to which it constantly leads. Parietal tumors, on the other hand, often progress without vomiting.

The vomitus consists of different particles of partially digested food; it has an insipid or rancid taste, a pungent acid or fetid odor, and, besides mucus, often contains some traces of blood. The production of HCl is very much decreased; free HCl is almost constantly absent, and pepsin and rennin are also much diminished. Boas lays special diagnostic value on the appearance of lactic acid, which, he believes, is not otherwise produced on carbohydrate ingestion. It is, however, not pathognomonic for cancer, and its appearance is due to the activity of the long bacilli constantly found in the stomach in cancer, first described by Boas and Oppler, and first cultivated by Kaufmann and W. Schlesinger.

Palpation and X-ray examination give valuable diagnostic aid. In rare cases, particles of tumor are vomited, which renders the diagnosis unquestionable. Sarcinæ ventriculi, frequently found in benign stenosis of the pylorus, are almost constantly absent, as is also yeast.

In the obstinate vomiting of cancer of the stomach, the washing out of the organ gives good results. If, in cancer of the pylorus, extirpation of the tumor is no longer possible, the question of gastroenterostomy as a palliative operation may be considered.

In recent times, thiosinamin has been recommended for the cicatricial stenosis of the pylorus, for its softening action on the scar tissue.

Sachs reports a case of cicatricial stenosis of the pylorus, following an ulcer, which had been treated with fibrolysin (salicylic thiosinamin), in doses of 1 c.c. every third day; sixteen injections were given in two and one-half months. In this time the patient showed a gain of 10 kg., the quantity of the urine increased from 400 to 600 c.c. to 1200 to 1800 c.c. daily, and the lower border of the stomach rose four fingers. The same author mentions a second case which had been treated by Klemperer for cicatricial stricture in the same way with the same good results; regular washing out of the stomach three times a week in the morning, a bland mixed diet, twenty injections of 1 c.c. each of a 10 per cent. solution of thiosinamin in glycerin water, at forty-eight-hour intervals. The success of this treatment is denied by other authors. In four cases of benign stenosis of the pylorus, Baumstark did not obtain any results, and believes that the right time for a life-saving operation may be passed by the hope placed in this treatment.

Other authors report an elevation of temperature following the injection of thiosinamin, which disappeared, however, after the use of increasing doses (Brunitzer).

Hypersecretion, too, may lead to vomiting. In this affection, violent gastric pains appear two to three hours after the meal, sometimes followed by the vomiting of a strongly acid liquid, so that the patient complains that his teeth feel on edge. Even for a long time after vomiting, there sometimes remains a sensation of severe burning in the pharynx and esophagus, and hoarseness. The vomited matter contains much undigested starch, only a few meat fibers, peptonized proteids, an enormous amount of free HCl, and only little mucus.

In the continued, as well as in the intermittent form of hypersecretion, attacks of pain which lead sometimes to vomiting occur on empty stomach, as, for instance, at night. The intermittent form is characterized by attacks which occur entirely irregularly. Cramp-like pains open the scene, followed by repeated vomiting, which continues as long as remains of food are present in the stomach, and finally a sour yellowish-green liquid is expelled in large quantities. After hours, in severe cases after days, the attack passes, and the patient feels entirely well again.

Of the remedies inhibiting secretion, atropin, morphin, opium, and silver nitrate have been used, but without great success. The best results are obtained by great doses of alkali. Reichmann recommends lavage of the stomach with a 1 to 2 per cent. solution of silver nitrate.

The diet should be nonirritating, and the difficultly digestible starches are better substituted by meat and other albuminous foods. Alkalis and Carlsbad waters are the therapeutical measures commonly used. In 50 per cent. of cases, hypersecretion is certainly produced

reflexly from the intestine; by flatulence, constipation, parasites, but also by duodenal ulcer. The causal treatment leads to prompt success in these cases.

Intestinal Diseases.—Vomiting is farther produced reflexly from the intestinal tract., *i.e.*, chiefly from its peritoneal covering, as in acute appendicitis and perityphlitis, simultaneously with the typical pain in the cecal region. Sometimes vomiting from the intestinal channel occurs without involvement of the peritoneum, as in severe dysentery and in intestinal parasites. Ulcers cause vomiting only if they are located in the duodenum, or have, through scar formation, led to irritation of the peritoneum. The vomiting demands a special therapy only when it is very violent, or when the danger of intestinal perforation threatens. The use of opium is indicated in such cases.

Vomiting is, further, one of the symptoms of acute intestinal occlusion, and indeed is sometimes its first sign, occurring the earlier and more abundantly, the higher and the more complete the seat of the obstruction, and the earlier peritonitis sets in (Boulloche). If this affection is of long duration, the vomited matter assumes a yellowish-brown color and a fecal odor. This is not usually the result of anti-peristalsis, though, according to the experiments of Nothnagel, Kirstein, and Rosenstein, this may play some part, but rather the result of a passing of the stagnant intestinal contents to the point of minimal resistance (Haguenots in Montpelier, and Van Svieten).

Peritoneum.—In cases of obstinate violent vomiting one must never forget to examine the accessible hernial apertures; one will think also of an internal incarceration, of a volvulus, and kinking, if sharp pain and shock render a sudden strangulation probable.

Less turbulent are the manifestations of obliteration, when an intestinal stenosis of long standing is increased by a gradual accumulation of feces, by enteroliths, foreign bodies, tumors with exception of lymphosarcoma, and invagination.

Peritonitis also may lead to the same symptom-complex, through paralysis of the intestines. The enormous tenderness of the abdomen on pressure, the diffuse meteorism, the board-like abdomen, speak in favor of the diagnosis peritonitis, while palpable, inflated, intestinal loops, complete obstruction even for gas, and the absence of exudate render ileus probable.

Ileus.—In ileus any intake of food has to be stopped at once, and large enemas, with 7 to 8 per cent. salt (Nothnagel), soap, ice water, or soda water (Ziemssen), may be tried. In this way relief may sometimes be given, and, if we have to deal with an invagination, it may be freed through these measures, resulting in cure. Curschmann recommends insufflation of air into the rectum with the same aim,

but it must be borne in mind that on beginning intestinal gangrene any exaggeration of this procedure may produce a rupture.

Cathartics and massage are absolutely contraindicated, but if volvulus is supposed to be present the following procedure may be tried. The patient is placed in the knee-elbow position, the physician supports the abdomen with his left hand, with his right clenched to a fist he administers short blows on the sacral and lumbar regions. As a result of this concussion, a happy chance may lead to reposition of an incarcerated movable kidney, or to the removal of an intestinal strangulation or volvulus. Lavage of the stomach is sometimes very serviceable in the vomiting. Of the internal remedies, morphin, chiefly opium, and atropin, much praised in recent times, are to be considered. If all this is of no effect, one will operate without hesitation. If an operation is not permitted, there remains still a procedure, sometimes useful, but certainly not without danger, proposed by Curschmann: It is the puncture of the intestine with a fine needle. Curschmann himself has obtained good results with this method. Others, as Fraentzel, bad ones. Probably this depends chiefly on the faculty of the intestinal musculature to contract or not, so that the intestinal wound so produced closes promptly, or else, after removal of the needle, does not contract allowing the intestinal contents to leak through.

The chronic occlusion of the intestine leads sometimes, but by no means constantly, to vomiting during exacerbations, which occur in attacks. The danger often is not imminent, the symptoms recede, movement of the bowels occurs, and the vomiting ceases. However, one must be prepared for an early repetition of the attack which is characterized by peculiar, colicky pain, with visible stiffness of the intestines (persistent peristaltic waves).

Intestinal Parasites.—The presence of intestinal parasites in rare cases causes vomiting, especially in the morning. It has been observed occasionally that the parasites, ascarides, or proglottides, have been vomited; the latter case is rendered possible if the head of the tænia adheres low in the bowel, and if its large joints lie toward the pylorus (Mosler and Peiper).

It is believed that hypersecretion as well as achylia may be brought about by the irritation of intestinal parasites. It has not been decided with certainty whether vomiting and other nervous symptoms, as bulimia and headache, are direct reflex manifestations on the part of the intestine or, are due to the action of the metabolic products of the entozoa.

If the presence of intestinal parasites is suspected, it is not necessary to try an exploratory medication and thus irritate the intestine

unnecessarily. The microscopic examination of the stools renders the diagnosis certain in the presence of eggs.

Digestive Disorders in Infancy.—That infants vomit much more easily than older children and adults has its cause in the more vertical position of the stomach, and in the slight development of the fundus. On left lateral position, the liver presses on the stomach, so that many infants vomit if, after feeding, they are placed on the left side. However, these mechanical explanations are not sufficient. A greater irritability of the nervous centers certainly plays a great rôle, even in childhood, after the period of infancy; thus uremia is much more frequently accompanied by vomiting in children than in later life (Janowski).

A great number of children, moreover, are constantly overfed, in breast feeding as well as in artificial feeding, if the breast is rich in milk and yields readily. Czerny rightly advocates only five, or, maximal, six feedings a day, for breast-fed children. All these causes explain the relatively slight importance and great frequency of vomiting in the first period of life, but each vomiting is the symptom of some digestive disturbance which must be attended to, contrary to the old German proverb "Vomiting infants are thriving infants" ("Spei-Kinder sind Gedeih-Kinder"). In uncomplicated cases it will be sufficient to restrict the quantity of food, or to shorten the time of nursing, and to control the quantity drunk, by weighing the child before and after nursing. The capacity of the stomach is, according to Pfaundler, in the first twelve months of life: 90, 100, 110, 125, 140, 160, 180, 200, 225, 250, 275, and 290 c.c. Every surplus of food leads to vomiting or to overdistension of the stomach, whose musculature is, anyway, not sufficiently developed.

In more severe disorders, we find vomiting almost constantly in the beginning as well as in the further course of the gastrointestinal affection, though sometimes the intestine exclusively is involved, and then vomiting may be absent. Overloading of the digestive tract, especially on feeding with cow's milk, leads to farther injurious sequelæ. Resorption suffers, and the abundant digestive residue furnishes an excellent culture medium for the development of bacteria, and this the more readily, since the disinfecting action of the gastric juice is almost zero in artificially fed children as a result of the fixation of the total HCl secreted. In this way infections of all kinds may develop. They may be divided into three groups according to Escherich:

1. The ectogeneous infection through milk. The milk contains bacteria in the spore form (Flügge) which, not killed by our methods of sterilization, lead to harmful processes of decomposition. Milk from a bad source cannot always be made wholesome even by sterilization (Marfan).

2. The chymous infection, in which the processes spoken of under 1. take place first in the intestine.

3. Infections of the intestinal wall with staphylococci (Moro), with streptococci (Escherich), B. pyocyaneus, dysentery, etc. Also protozoa play a role in certain epidemics (Flagellata, Escherich; Monocercomonas, Epstein).

According to the severity of the clinical symptoms Escherich distinguishes:

1. The dyspeptic stage, a functional disturbance of resorption.

2. The catarrhal stage, characterized by mucus in the stools.

3. Inflammatory stage (blood, pus, intestinal epithelium in the stools).

The prophylaxis of these conditions comprises the whole doctrine of infant hygiene, which cannot be discussed here.

The treatment of vomiting and its primary cause may be considered briefly.

In severe cases, especially in acute gastroenteritis occurring in hot weather—the much-dreaded cholera infantum—the treatment should be begun with *tea* as the exclusive food for twenty-four hours, eventually for longer. The quantity should be abundant, but corresponding to the age of the child. The stomach must be washed out, except when the bacteriological examination of the stool has proved that the mucous membrane of the intestine itself has become infected. In this case mechanical and chemical intestinal disinfectants are scarcely of any value, and our chief aim will be to maintain the strength of the child.

In cases where abnormal decomposition of the intestinal contents is supposed to be the pathogenetic factor in the disease, calomel in doses of 0.01 to 0.03 gm. two to three times, every three hours, may be given until the characteristic abundant gray-green stools appear.

Rp. Acid muriat. dil., 0.5 70.0
or
Resorcin resubl., 0.2 70.0

or, according to Salge,

Rp. Inf. chamomill., 60.0
Resorcin resublim. merck., 0.1
Tct. opii gutt. I.
MDS. Ten c.c. three times a day.

After the acute symptoms have passed, it is best to return to breast feeding; if this is not possible, a change in the nourishment should be instituted; children's foods, as Kufeke, Nestles', Rademacher, and Mellin's food may be given if the child has received only milk previously. One may begin with 1 tablespoonful of the food to 15

tablespoonfuls of water. Gradually one may again return to milk feeding. Other authors prefer the albumen water of Demme to the flour soups. It is prepared in the following way: The white of one egg is mixed with 4 teaspoonfuls of powdered sugar, to which is added gradually half a liter of water, previously boiled and cooled. The solution cannot be warmed too much, as the albumen would coagulate into floccules.

Predigested milk may be tried: it is treated with pancreatic ferment, producing a whey whose fat content is increased by the addition of cream. In cases where intolerance for fat is a chief symptom of the affection and where the fat is very badly split, milk preparations poor in fat will be indicated, as buttermilk and Liebig's soup. Indeed there are cases in which breast-fed children tolerate the mother's milk only after it has been freed from fat by centrifugation.

Congenital Stenosis of the Pylorus.—Vomiting is, farther, a cardinal, symptom of a disease, as yet not entirely understood, the stenosis of the pylorus in infants. The cases of severe congenital stenosis are ungrateful subjects for the practitioner, who can hardly advise an operation which is very often fatal (gastroenteroanastomosis). In these cases we have probably to deal with congenital organic stenosis (Frannenroth).

The lesser degrees of stenosis, or the pylorospasms, are affections which, though rare, are clinically important and of good therapeutical prospects. Also in the myoma-like muscular hypertrophies, improvement may take place, through compensatory hypertrophy of the expelling musculature, as in stenosis of the cardiac orifices. This compensation does not seem to persist, however, and leads to manifestations of pylorus stenosis in children and adults, the clinical description of which has been given by Lebert (Finkelstein, Schotten). Everything taken in is brought up, the milk is not coagulated usually, and an admixture of bile is never present. This disease is innate, or develops in the first weeks of life, during which time there may or may not exist a tendency to vomiting. The appetite is good, but half an hour after eating the child screams painfully, bends himself together, and on being uncovered one sees peristaltic waves passing over the stomach which sometimes are tetanic in character, in some cases they may pass from right to left—antiperistaltic. Obstinate constipation and progressive emaciation of the severest degree are present. Thomson and Pfaundler do not regard the stenosis as an organic affection but as an entirely spastic one.

Knöpfelmacher, too, reports such a case with hyperchlorhydria. The first aim of the treatment will be to try natural feeding; if this does not succeed, a trial may be given to undiluted cows' milk, which, on account of its high faculty of fixing acids certainly removes the

harmful action of the hyperchlorhydria. In other cases Biedert's cream mixture may be tried, as advocated by Bendix, who starts with very small portions of ramogen, giving 20 to 50 c.c. every hour. If human milk cannot be obtained, Pfaundler gives pegnin (full milk) with 6 per cent. milk sugar. Heubner allows the children to nurse every three hours, since, though they vomit, a certain quantity always remains in the stomach. Lavage of the stomach, so valuable in other affections, is, according to some authors, useless, and perhaps produces dilatation of the stomach. Pfaundler has undoubtedly obtained relaxation of the spasm and improvement of the symptoms by washing out the stomach twice a day with cool water (12 to 16° C.).

In regard to the medicinal treatment, anesthesin in doses of 0.15 to 0.25 gm. is given half an hour before feeding or:

Rp. Magnes. carb.,	2.0
Tct. opii simpl.,	Gutt. ii–iii
Aq. destill.,	90.0
Syr. simpl.,	10.0

DS. One dessertspoonful every three hours.

Cathartics are to be avoided. Heubner applies warm poultices three times a day for two hours, and gives a few drops of tincture of valerian mixed with 1/10 to 1/20 drop of simple tincture of opium every three hours.

Pfaundler also recommends prolonged baths, infusions of physiological salt solution, and high enemas, in order to combat the exsiccation. If, as a last resort, operation is decided on, stretching of the pylorus (divulsion of Loretta) has first to be considered, and, in the second place, gastroenterostomy.

Atrophy of Infants.—In that eminently chronic disorder of nutrition in infants, which we include under the term atrophy, vomiting is sometimes observed with otherwise apparently good digestion, as the children drink large quantities of milk, acquiring at once in this way distention of the stomach. Systematic lavage of the stomach is perhaps of some value in these cases.

Melena Neonatorum.—Melena neonatorum, hematemesis of the new-born, is a rare affection, developing as early as the second day after birth. Hematemesis and bloody stools follow a hemorrhage of the digestive tract (M. vera), or simulate such a hemorrhage (M. spuria); in the latter case, the blood being that of the placenta swallowed during birth, or coming from the nose of the child or the nipples of the mother. The treatment consists in giving a 5 to 10 per cent. solution of gelatin subcutaneously or internally in doses of 1 teaspoonful, breast feeding, and protection against loss of heat (collapse).

We shall now again return to adults.

Inflammatory and traumatic irritation of the peritoneum usually incite vomiting.

Vomiting in Intestinal Perforation.—Vomiting occurs very frequently in acute peritonitis, especially in perforation. It appears together with fever and chills, meteorism, and an abnormal tenderness of the abdomen. In the farther course of the disease, and on the appearance of somnolence, it gradually disappears. In children it may be entirely absent. In this form of vomiting the abdominal musculature participates only little, the vomiting gives no relief, and the pain and tormenting thirst are increased. The application of cold, small fragments of ice, and opium internally, are still the most effectual measures against this symptom.

The Vicious Circle.—In gastroenteroanastomosis, vomiting may occur if a *circulus vitiosus* has formed in the movement of the chyme. The treatment of this very serious condition lies in the sphere of surgery.

Combating Exsiccation.—In all cases where the vomiting has led to exsiccation through insufficient intake of food and excretion of water through the intestinal mucous membrane, it must be combated by "thirst-enemas" or, better, through infusions of physiological salt solution.

In infants 200 to 300 c.c.

In adults 500 to 1000 c.c.

Pharyngeal Vomiting.—Vomiting may also be excited from the palate, the pharynx, and the tongue, as well as from the nose. In catarrhs of the pharynx and larynx, nausea and vomiting are especially frequent in the morning. Long-stemmed polyps of these organs may also produce this symptom.

Vomiting in Liver Disease.—In liver affections, as in gall-stone colic, vomiting is common. In cholelithiasis, contrary to many gastric affections, vomiting does not relieve the pain, but rather increases it. In catarrhal jaundice, cirrhosis and abscess of the liver, and acute yellow atrophy, it may arise. It is caused in part by the primary catarrh of the digestive organs, in part by their secondary involvement due to stasis in the portal vein, or by toxic irritation of the center for vomiting. Also in diseases of the pancreas and suprarenals it may be met with.

Diseases of the Urinary Organs.—Patients with kidney affections vomit frequently, during an attack of renal colic caused by a calculus, on incarceration of a movable kidney, or in the course of a nephritis which, if acute, may set in with uremic vomiting, if chronic, may show it in its farther course. In acute cystitis, vomiting is only rarely observed, and then together with singultus.

Vomiting Following Violent Cough.—All diseases with intense cough-

ing spells lead to vomiting, if the attack is an especially strong one. The centers for cough and vomiting are in close relation to each other, not only topographically, but also functionally. Therein lies the explanation that all the so-called expectorants are in fact emetics, being used only in small doses, when it is our object not to produce vomiting, but to remove mucus from the air passages.

Pertussis.—Thus vomiting is found in whooping-cough as a constant symptom, chiefly in the convulsive state. The vomited matter is, in respect to the gastric functions, normal, mixed with some glassy, thread-like mucus which is sometimes blood-tinged, and comes from the trachea and pharynx. In the final stage, when the mucous membranes, under an abundant secretion of thick, yellow pus, return to normal, this secretion becomes mixed with the stomach contents. After disappearance of the pertussis, a typical whooping-cough spell, even with vomiting, may for some time be easily incited by the usual violent cough in the course of a bronchitis. This is a reflex, traveling a much used path, a phenomenon to be observed in other cases in the physiology of the nerves. It is important to have a knowledge of this fact, for confusion with the infectious diseases which have completely run their course may be avoided only through anamnesis. Vomiting in pertussis will be improved by the treatment directed against the disease. A nonirritating diet of great nutritive value should be given at small intervals. It may be given immediately after vomiting if the mouth has previously been cleansed. Trousseau states, probably correctly, that solid food is more readily retained and endured in whooping-cough than liquids.

Phthisis.—In pulmonary tuberculosis, and especially in laryngeal phthisis, violent and repeated vomiting often jeopardizes the nourishment necessary for recovery.

Gynecological Diseases.—Affections of the female sexual organs may be associated with vomiting, frequently observed in posterior parametritis. It is an initial symptom of pregnancy, disappearing usually in the fourth month. In other cases it persists throughout pregnancy. Cases are known where even the induction of premature birth was fruitless, and the patient died of hyperemesis. The intolerance of the stomach ceases immediately, in most cases, after expulsion of the child. The vomiting of pregnancy in light cases occurs only in the morning or following meals, but sometimes independent of them, and not seldom accompanied by pyrosis and gastralgia. Bulimia may appear immediately after the act of vomiting.

Diseases of the digestive or other abdominal organs sometimes lie at the bottom of this vomiting, which is aggravated by pregnancy.

The correction of the displaced uterus or improvement of inflammatory conditions may bring about a favorable change. In other

cases the stretching of the uterus, or a general nervous constitution has to be considered as the causal factor. It would certainly be wrong, however, to consider every woman suffering from hyperemesis gravidarum as hysterical and to try to heal her by suggestion. That the possibility for psychical influence exists in many cases is shown in the treatment with simulated silver nitrate douches of the portia, which are applied after the physician has strengthened the confidence of the patient in this treatment by douches with actual silver nitrate in 10 per cent. solution.

Henning reports the case of a pregnant woman in whom the vomiting persisted after birth, ceasing only after healing of a cervical laceration.

Absolute rest, intake of food in the horizontal position, and care of the bowels sometimes prove of use.

Of drugs, menthol, best dissolved in cognac or in tinctura amara, anesthesin, or cerium oxalate in doses of 0.2 to 0.3 gm. several times a day may be tried. Morphin may have to be considered.

The method of Fliess, which has proved excellent in some menstrual troubles, may be tried. It consists in cocainization of certain parts of the nasal mucous membrane.

Partisans of the hypothesis of autointoxication recommend lavage of the stomach and intestines to remove the toxins, combined with rectal feeding; only when all manifestations have disappeared may feeding by mouth again be cautiously tried.

To stop the attacks of vomiting L. Pick advises the patients to sit down and bend the head strongly backward.

Diseases of the Labyrinth and Ear.—Vomiting is very frequent in various diseases of the labyrinth, in trauma and blood extravasations into the labyrinth, in the syphilitic affections of this organ, and in Ménière's symptom-complex, which consists in dizziness, tinnitus, difficulty in hearing, and often vomiting. The acute purulent inflammation of the middle ear and polyps of the tympanic cavity are frequent causes of vomiting, the first especially in children. Certain forms of hysteria which remind one of Ménière's symptom-complex may be accompanied by nausea or vomiting.

II. CENTRAL VOMITING

Cerebral.—Vomiting is found quite frequently in cerebral conditions if they irritate the center of vomiting, which lies on the floor of the fourth ventricle. This irritation may be due to a general increased intracranial pressure, which is transmitted to the ventricular cavities, or to a variation of pressure in the brain.

Brain Tumors.—Brain tumors located in the cerebellum, in the

pons, or in the medulla oblongata, commonly produce attacks of headache, vertigo, and vomiting; this latter symptom, however, is overshadowed by the severity of the other manifestations. Also acute and chronic inflammatory changes in the brain, as well as brain abscess, hemorrhage, and acute anemia of the brain, are, in the beginning, often associated with vomiting.

Meningitis.—It is the first symptom of tubercular meningitis, and therefore, if frequently appearing in the first years of life, without known cause, a symptom which demands most careful observation. One inquires whether the child has changed in his whole nature. In the beginning of meningitis the children sit dreary and passive, they weep easily, open the mouth widely for a shrieking cry, and are then quiet again. At times they sigh deeply, gnash their teeth during sleep, make sucking movements, and smack their lips. Elder children complain of headache. The pulse is usually slow and arrhythmic; constipation, stiffness of the neck, Kernig's symptom, and Trousseau's spots may be present. A recession of these symptoms is rare. A pronounced meningitis usually follows this stage of central irritation, which probably corresponds with the first dissemination of tubercles on the base of the brain. In epidemic cerebrospinal meningitis, which has a turbulent onset with fever, headache, and rigidity of the neck, vomiting is almost never absent in the beginning, as in meningitis of the convexity of the brain, in cerebral edema and in ependymitis.

Concussion of the Brain.—Vomiting is a constant symptom in concussion of the brain, appearing immediately after the trauma, and occasionally associated with loss of consciousness, mydriasis, bradycardia, and superficial irregular respiration, interrupted by deep inspiration. This condition may disappear after a few minutes, or last for hours and days. A free interval of several hours may follow, and then renewed symptoms of cerebral pressure, namely, when the medial meningeal artery or one of its branches has been injured, the hemorrhage producing symptoms only when the hematoma has become sufficiently large.

Concussion of the brain in children, in general, takes a faster and more favorable course, yet in children affected by heredity, tubercular meningitis not seldom develops on the basis of a cranial trauma.

Pressure on the Brain.—In the severe forms of hydrocephalus, vomiting occurs spontaneously, as well as on slight irritation (slight pressure on the skull). The diagnosis is assured by the size of the skull, the disproportion of the facial portion of the skull as compared with the cranium, the downward pressure of the bulbi, and the protrusion of the fontanels. In infants the diagnosis is easy if one has learned to judge correctly the tension of the fontanel. Its pulsa-

tion and the perception of a systolic blowing (cephalic bellows) are symptoms of no value for the diagnosis of increased central pressure.

If one compresses an encephalocele or a spina bifida, one produces experimentally a transient increase of the cerebral pressure, and in this way vomiting, a symptom which demands the instantaneous interruption of this experiment. Cerebral vomiting, in general, is characterized by the fact that it occurs without nausea and without much straining, notwithstanding the excellent state of the appetite and independent of the quality of the food. Liquids are usually even more badly tolerated than solid food.

Small fragments of ice, ice-cream, cold applications on the head and abdomen, and morphin may be tried.

Sunstroke; Ménière's Disease; Morbus Basedowii; Hemicrania; Sea-sickness.—Subjects of sunstroke, Ménière's disease, Graves' disease, and migraine sometimes vomit, owing to vasomotor disturbances of circulation in the brain. It is, further, a frequent symptom in hemicrania, and a constant one in sea-sickness, two conditions which sometimes show a remarkable similarity. The diagnosis of migraine is made from the anamnesis, the attacks having existed since early youth; a hereditary disposition can often be traced back in the family. In this condition vomiting is usually one of the latest symptoms, but in rare cases it may last during the entire seizure. As it concludes the attacks so often, attempts have been made to provoke it by artificial means, but without success.

For sea-sickness, a condition so generally known and so agonizing, no reliable remedy as yet exists. Stintzing has recommended the prescription of 2 to 4 gm. sodium bromid each day for two to three days before the sea voyage. During the voyage the patient keeps as much as possible in the middle of the ship, taking a horizontal position and looking far out over the sea, if possible always on the horizon. Cocain hydrochlorate in doses of 0.03 to 0.05 gm. helps in short passages, as for instance in crossing the English channel (Rosenbach).

Following Anesthesia.—As the last form of cerebral vomiting we mention that following general anesthesia.

E. Graham has recently obtained very promising prophylactic results by lavage of the stomach with pure olive oil.

Spinal.—Another form of nervous vomiting is spinal. It occurs in diseases of the cervical medulla (myelitis from pressure, acute anterior poliomyelitis with high location), in multiple sclerosis, and in tabes dorsalis. In the last disease there are attacks of severe pain, localized in the epigastrium and between the scapulæ, combined with uncontrollable vomiting (gastric crises). Qualitative analysis of the gastric contents shows no constant changes (v. Noorden). These

crises are sometimes the first symptom of tabes dorsalis, and frequently are not recognized but are diagnosed as periodic vomiting (cave laparatomiam!). Patients suffer greatly from these attacks which may even cause death from cardiac weakness (v. Leyden and Goldscheider). If pain is absent during the vomiting attacks, we may speak of a hyperemesis spinalis (Berger). On the other hand, gastralgia without vomiting is also observed in tabes. Though the medication with morphin may very easily lead to the drug habit, especially in gastric crises, still we have no better remedy with which to calm the almost intolerable sufferings of the patient. Continual vomiting leads to an alkaline reaction of the urine (Cathelineau) owing to impoverishment of the organism in acids. With this there exists unbearable thirst, and impoverishment of water. Small fragments of ice must be administered, or the application of cold over the region of the stomach must be made. Faradization of the abdomen with a faradic brush may be tried, or with a large plate electrode (anode). Benedikt cauterizes over the stomach region, and even over the spinous processes. On long duration of the attack, nutrient enemas and salt infusions are to be tried, to check the inanition and dehydration. By abundant nourishment after the attack, we must try to regain what the body has lost.

Toxic.—The center of vomiting may be stimulated directly by the blood. The changes in the quality of the blood which cause this stimulation are produced by infection and intoxication. Vomiting is a very frequent prodromal symptom in infectious diseases, as in exanthematic typhus, and in relapsing fever. The onset of scarlet fever so frequently begins with vomiting that, in doubtful cases, this symptom may be used in favor of the diagnosis. Vomiting is also to be observed in erysipelas, diphtheria, pyemia and septicemia, typhoid fever and variola, the gastrointestinal form of influenza, summer diarrhea of infants, and Asiatic cholera.

Ectogenous.—In the course of autointoxications, as uremia and intestinal autointoxications, vomiting is a constant symptom. The best example of toxic vomiting is that produced through a subcutaneous injection of apomorphin. It is, further, a typical sign in poisoning with morphin, alcohol, and snake venoms.

Nervous Vomiting.—We consider vomiting to be of nervous origin when it is called forth neither by an abnormal external stimulus nor by a disease of the organism. This occurs in hysterical or neurasthenic individuals, the composition of the vomitus furnishing no evidence as to the nature of the affection. In general it occurs in persons who show other symptoms of hysteria or neurasthenia, but it must not be forgotten that it may also be associated with constitutional or organic diseases, so that we will declare a diagnosis of nervous vomit-

ing only with the greatest caution, and bear this fact constantly in mind.

According to Stiller ("Nervous Diseases of the Stomach," Stuttgart, 1884) it is characteristic of nervous vomiting that it occurs without nausea, is frequently independent of the quality and quantity of the food, and that easily digestible food is often vomited while indigestible food often is much better borne. We confirm the opinion of this author that the vomiting is elective, that is, that certain foods are expelled while others are retained. Very often merely psychical impressions bring it on, in other cases, certain odors or tastes.

To this belongs the hysterical bloody vomiting mentioned by several authors. It is usually observed as a vicarious hemorrhage during menstruation in hysterical women, in whom, previously, other stomach manifestations were present (Bouveret). In general, we have to deal only with very small amounts of blood which are mixed with the vomited matter; in this connection it is to be remembered that hysterical patients often s mulate bloody vomiting, when in reality the blood is from the gums or pharynx. We emphasize once more that only the exclusion of stomach affections or other disease which might lead to vomiting, and the presence of marked hysterical symptoms will permit the diagnosis of "nervous vomiting."

A frequent cause of vomiting is the hyperesthesia of the stomach which is especially marked in hysterical individuals. Those stimuli which, under normal conditions, affect the gastric mucous membrane without being perceived are felt in these cases. In such patients, with their increased irritability of the sensory nerves of the stomach, a normal quantity of food will evoke vomiting, just as immoderate amounts will in healthy persons.

The diagnosis of nervous vomiting offers great difficulty, especially in those cases where a direct relation exists between the intake of food and attacks of pain and vomiting. Here the differential diagnosis between nervous vomiting and ulcer of the stomach is very difficult, especially as points of tenderness in the back and epigastrium are also present in neurosis.

Concerning the symptoms which are important for the differentiation of the two affections it is to be noted:

1. That liquids are as badly borne, or more so, than solid food in contradistinction to ulcer in which fluids usually cause less pain.

2. That between the attacks of hyperesthesia, which may vary in length, there are periods of entire well-being, when even difficultly digestible food is well borne.

3. That the points of tenderness do not lie at the left of the spinous processes of the thoracic and lumbar vertebræ, but higher up, and on the spinal column itself, often between the scapulæ.

4. That the stomach contents are generally of normal acidity.

5. That the pain is diminished on faradization, whereas in ulcer it is increased.

6. That other symptoms of hysteria are usually present.

Periodical Vomiting.—A peculiar form is the periodic vomiting described by v. Leyden (*Zeit. f. kl. Med.*, 1882) and Mayerhoff (*D. med. Wochen.*, 1881). It consists in frequent attacks of vomiting, changing with periods of complete well-being. As the causes of this condition were assigned repeated mental affections, mental overexertion, the abuse of tobacco and alcohol, Graves' disease, chlorosis, and traumas of the epigastrium. It was even observed in children, and repeatedly described by French and American physicians (periodical vomiting). According to the belief of these physicians this vomiting is associated with large amounts of acetone and diacetic acid in the urine (Escherich). It is noteworthy that the acetone appears so early in the urine that its presence cannot be ascribed to inanition. In the differential diagnosis, gastric crises and, on account of certain symptoms, tabes are to be excluded.

Habitual Vomiting.—Many persons possess a congenitally increased irritability of the vomiting center; in others the act of vomiting is easily excited in connection with some affection of the stomach where the pathway is a much trodden one, due to frequent vomiting; we then speak of habitual vomiting. In such cases the sight or the mere idea of certain food excites vomiting. In nervous, irritable individuals, psychical emotions may lead to immediate vomiting. The appetite may be entirely normal throughout.

Habitual vomiting often occurs in nervous children, especially after breakfast, without any demonstrable cause. Psychical emotions will also lead to vomiting in such children. This is not a dangerous condition, but it brings the patient down greatly in his state of nutrition. A roborant treatment offers the most effective results.

Preagonal.—Heart-death following diphtheria is often announced, shortly before its appearance, by an intense pallor, vomiting, and diarrhea. All treatment is useless, though, of course, the usual heart tonics may be tried. It is still uncertain whether anemia of the brain, a toxic effect on the centers in the medulla, or a reflex stimulation of the vagus is the cause of this symptom.

Factors Inciting and Inhibiting Vomiting.—The following factors tend to render the occurrence of vomiting easy:

1. Individual sensibility.

2. Age of the child. The younger the child the more easily it vomits.

3. Heightened temperature. The more rapidly the fever rises, the sooner vomiting occurs. In scarlet fever patients often vomit; in typhoid fever seldom.

The nephritis of scarlet fever causes vomiting more readily if it is associated with fever than if it is not, the same intensity of the case being understood.

4. Anemia and venous hyperemia of the brain, if the latter is not of too long duration.

The appearance of vomiting is, on the other hand, retarded:

1. By dilatation of the stomach. The sensibility of the gastric mucous membrane is lowered, and the muscular work required on the part of the stomach and the abdominal pressure are much increased.

2. By inflammatory processes in the region of the œsophagus which hinder its contraction, and in œsophageal stenosis.

3. In narcotic poisons in medicinal doses, if no idiosyncrasy against them exists (as, for instance, against morphin).

4. In venous stasis of long duration, when the sensibility, at first increased, has again sunk.

5. By bulbar affections of all kinds.

6. By paralysis of the diaphragm.

CHAPTER VIII

DISTURBANCES OF INGESTION

In a great number of diseases of the oral cavity, pharynx, esophagus, and stomach, as well as in different nervous and surgical affections of all kinds, the ingestion of food may be rendered difficult or impossible. The danger of this symptom needs no explanation. Though at present we have a number of measures at hand which, to some extent, ameliorate the threatening nature of this condition so that it is possible to prolong life for some time without nourishment in the natural way, on long duration only surgical intervention, the formation of a gastric or duodenal fistula will make it possible to furnish the necessary nourishment, when there is an irremovable obstacle to ingestion.

The cause of hindered ingestion may, first of all, be due to pathological changes in the oral cavity.

A. HINDRANCE IN TAKING FOOD INTO THE MOUTH

Even in the new-born there exists a number of congenital and acquired affections in which this dangerous condition is present. Malformations in the region of the oral cavity may render nursing very difficult, or entirely impossible. In most cases we have to deal with harelip and cleft palate.

Harelip and Cleft Palate.—The first-mentioned affection is, of itself, not a very severe hindrance to the intake of food; but if it is combined with cleft palate, the prognosis is at least doubtful, especially in very delicate children. The act of sucking is hindered because an air-tight closure on the nipple is impossible; the act of swallowing, too, does not follow promptly, as a great part of the liquid taken in regurgitates into the nose.

However, one should try to nourish the child at the breast as far as possible.

In spite of all difficulties, some children learn to produce a sufficiently tight closure to supply themselves with the necessary quantity of food from the breast. When this is impossible, the milk must be pumped out and given with the spoon far back on the base of the tongue. If we do not succeed in this way, either because the children strangle or because the fluid runs out again through the nose, the

child must be fed with a tube in order to save the life. Unquestionably the best food is human milk, which is easily gained by a breast pump.

The operation for harelip will have to be performed in the first weeks of life in urgent cases, whereas the cleft palate is scarcely operable in the first year of life, though Julius Wolff has operated even in nurslings with good success.

Other still more severe congenital defects, with clefts in the face, render the prognosis of these malformations correspondingly more unfavorable.

Tetanus Neonatorum.—Another hindrance to nursing observed in the new-born is caused by the spasm of the muscles which produce the act of sucking. This is the tetanus neonatorum, and the symptom mentioned may be its initial manifestation. After a few sucking movements the child drops the breast or the bottle with a cry of pain, due to the cramp of the muscles of the cheeks. Though the danger of the disease is chiefly dependent on the severity of the infection, the hindered supply of nourishment in the course of tetanus is certainly a most important factor in the unfavorable prognosis.

In the treatment the greatest stress must be laid on sufficient nourishment. If we do not succeed in giving mother's milk with the spoon, a Nélaton catheter, which is just small enough to pass the orifice of the nose, is introduced, a funnel attached, and the necessary quantity of warmed human milk brought into the stomach in this way.

The mechanism of sucking is such that when the lower jaw is moved downward the tongue remains passively lying on the floor of the oral cavity.

Anomalies of the Tongue Hindering Nursing.—It is, therefore, to be expected, and experience has confirmed it, that malformations of the tongue do not influence the act of nursing. Indeed, Jussieu has described complete absence of the tongue in a girl of fifteen years (Butlin).

The longitudinal cleft of the tongue (lingua bifida) is of little importance for the food supply. The old physicians placed great weight on the loosening of the frenulum linguæ, thinking in this way to remove the hindrance to nursing, a traditional intervention which rests on a false conception.

Anomalies of the Oral Floor Hindering Nursing.—Sublingual tumors as carcinoma, lymphangioma, retention cyst, branchial cyst, which may be congenital, or develop in the first months of extrauterine life, on a congenital predisposition, may be an impediment to sucking and demand operative treatment.

Congenital Facial Paralysis.—Among the congenital causes of hindrance to nursing, paralysis of the facial nerve plays a great part; if bilateral, nourishment of the child in the first weeks is possible only

by the sound. This paralysis develops from pressure by the forceps during birth. Its treatment consists in the use of the faradic current, with a labile kathode.

Coryza.—If the nasal respiration is hindered, whether through a syphilitic or a common coryza, or through nasal diphtheria, the children are unable to nurse. They must constantly drop the nipple in order to gain air through oral inspiration. Indeed, Baginsky believes that in the course of a coryza without pulmonary complications, sudden death may occur from exhaustion in the new-born. It is, therefore, best not to take the coryza of infants too lightly. Care for constantly warm, moist, dustless air must not be neglected. The nasal passages must be cleansed with little pledgets of cotton wadding, to remove the crusts of secretion; this manipulation produces sneezing which also serves to free the passage.

Inhalations of pine oil are said to give good results sometimes. Instillations of a 1 per cent. solution of menthol paraffin, of 1 drop of a 1/2 to 1 per cent. silver nitrate solution, of a 1 per cent. cocain solution (maximal dose 2 drops three times a day), and the introduction of absorbent cotton saturated with an ointment of white precipitate or a 1 to 1000 adrenalin solution for a few minutes, may give transient relief.

B. HINDERED MASTICATION

Stomatitis.—*Thermic; Chemical.*—Severe stomatitis of whatever nature may become an important factor in hindering nourishment. Stomatitis may originate from mechanical, thermal, and chemical irritation. Severe burning and cauterization may lead to immediate death from edema of the glottis. Persistent severe troubles in swallowing are to be dreaded only in those cases in which the pharynx and especially the esophagus are involved. In those numerous fortunate cases where the caustic fluid is at once retched out reflexly, and therefore could not go farther than the soft palate, a complete restitution, as far as the intake of food is concerned, is again established. At the time of the violent reaction small fragments of ice may be melted in the mouth, and the pain may be relieved by the local application of cocain and injections of morphin. Ice-cold milk may be drunk; an antiseptic mouth-wash will be indicated.

Mercurial Stomatitis.—Mercurial stomatitis is often the initial symptom of severe cases of mercurial poisoning. It is found in those who work with mercury and in medicinal intoxication. This occurs in the inunction treatment, in injections with corrosive sublimate, and following the internal use of calomel. The latter is often given in too large doses by physicians who neglect the fact that calomel is

a laxative in enteritis, but no drug with which to combat constipation, and that if calomel has been used without effect for six to eight hours another dose of it must not be given, but the first must be followed by another laxative, for instance, oleum ricini. In the severe form of mercurial stomatitis the formation of ulcers occurs first on the gums of the inferior incisors and canine teeth.

The ingestion of food, as well as mastication, is very painful in this affection. Careful prophylaxis is therefore necessary; it consists in great attention to the mouth during mercurial treatment.

The oral cavity should be disinfected through washing with a 1/4 per cent. solution of sublimate or a 2 to 3 per cent. solution of hydrogen peroxid, or with the following mouth-wash:

Rp.	Menthol,		1.0
	Tct. ratanhiæ,		
	Alcohol,	āā	50.0
DS. Mouth-wash.			

Ulcers already developed are best cauterized with a silver nitrate pencil and rendered insensible, before the intake of food, by painting with a 5 per cent. cocain solution. In all cases of severe mercurial stomatitis the treatment must be discontinued.

Lead stomatitis scarcely ever becomes so severe as to disturb the ingestion of food.

Phosphorus Necrosis.—The changes in the oral mucous membrane in phosphorus necrosis are, as a rule, of a severe nature. That terrible industrial disease, which fortunately is constantly becoming more rare, begins with falling out of the teeth, and, as Albert has expressed it, the "alveoli lie exposed like cups filled with pus." From periodontitis, an osteomyelitis of the bones of the jaw may develop; numerous fistulous openings in the livid gums, out of which oozes pus, lead, as may be found by probing, to rough sequestra of bone.

Surgical intervention will be necessary to drain the collection of pus and to remove the sequestrated bone. The aspect of the patients is particularly sallow, almost cachectic; in some part this may be due to disturbed nutrition, which is readily understood owing to the severe changes and pain caused by them. A rich supply of food in liquid or purée form is therefore indicated.

Catarrhal, Aphthous, Ulcerous, and Gonorrheal Stomatitis.—Catarrhal stomatitis is caused not only primarily by various mechanical, thermic, and chemical noxæ, but also, secondarily, by acute febrile diseases. The patients, however, complain of the discomfort of the stomatitis more than of the primary disease. They want, above all, to be relieved of the pappy taste and the fetor *ex ore*. Especially in influenza a peculiar form of stomatitis is an important

symptom, whereby the tongue has an opalescent appearance (Raynaud). The consequence of this affection is that the patient refuses to eat and drink and the nourishment suffers for a long time, until the period of convalescence.

In all severe diseases associated with somnolence a more or less pronounced stomatitis is present, which, though not of great importance in the nutrition, should always be treated, to prevent a secondary infection of any kind.

Rinsing with a 4 per cent. boric acid solution; or with a 2 per cent. solution of chlorate of potash, and, in somnolent patients, painting with boric acid glycerin, 1:5, will prove useful. The oral mucous membrane in small children may be touched with cotton pledgets dipped in a 1/2 to 1 per cent. silver nitrate solution or in a 5 per cent. solution of sodium biborate. The food must be liquid or soft, and cool; salt and acids should be avoided.

Aphthous stomatitis is a specific infectious disease, caused by an unknown germ, which may cause transient, but considerable disorders of the general condition. Fibrinous patches on the lips, cheeks, and tongue, and the reddening and swelling of the whole mucous membrane, sometimes cause violent pain on ingestion. The patients, usually children, refuse everything except cold drinks. The disturbed nutrition does not mean very much, as the disease is of short duration. The treatment in small children consists of the internal administration of a dessertspoonful of a 1/2 to 1 per cent. solution of chlorate of potash every two hours and of painting the mouth with a 2 per cent. solution of silver nitrate. Cold milk usually is readily taken.

Ulcerations in the oral cavity may be due to trauma from biting the tongue during an epileptic attack and to the irritation of carious teeth, especially if an anomaly of constitution, as diabetes or scrofula, favors their development. In ulcerative angina an unknown contagium has to be considered as etiological factor.

This disease occurs in epidemics in children's hospitals and in orphan asylums, and, more rarely, in barracks and prisons, as it attacks children especially in the period of dentition. Nurslings are usually spared, but older individuals not; the affection is confined to the portions of the gums which still hold teeth; where gaps occur in the teeth it is not found. The gums are swollen into a red or bluish-red mass, which penetrates, pyramid-like, between two teeth. The gingiva bleeds easily and at its margin is decomposed into a greasy, gray-yellow mass. In severe cases coated discolored ulcerations are found also on the inside of the cheeks and lips and on the margins of the tongue; the connective tissue of the cheeks and the floor of the mouth may be tense and infiltrated with a serous exudation; the local lymph glands are tender, enlarged, and palpable. The process

may heal in a few weeks or take a chronic course. Though the general manifestations are usually slight, much less than in the aphthous stomatitis, the nutrition suffers a great deal through the inability to masticate and the discomfort on swallowing if the disease attacks the gums or more rarely the isthmus of the fauces.

The therapy consists in the correction of injured teeth and the removal of tartar on the teeth and of the decomposed parts of the gingiva by a pledget of absorbent cotton dipped in tincture of iodin or of galla. Or the affected parts may be touched by a glass rod dipped in concentrated carbolic acid and afterward powdered with orthoform.

In the new-born there occurs, further, a rather harmless gonorrheal infection of the oral mucous membrane, which is treated with a 1 per cent. solution of silver nitrate.

Thrush.—Another form of stomatitis in infants is caused by oidium albicans (thrush), which renders the intake of food painful, and in this way may bring down the vitality of children very much. Considering the influence of thrush on the general health, it is well to remember that it usually arises only on the basis of a gastrointestinal disturbance. This is especially true in older children and adults; in infancy it may be met with in otherwise good health.

The treatment consists in a very gentle local application of a 0.02 per cent. solution of sublimate solution, with sodium biborate in a 2 to 3 per cent. solution, in insufflations of boric acid, or, a very convenient way, in the use of the boric acid nipple of Escherich. This consists of a small sack of gauze containing a pledget of cotton filled with finely pulverized boric acid. Before use it is dipped into a diluted saccharine solution.

Bednar's Aphthæ.—Ulcer formation on the palatine ridges and on the raphe are sometimes caused by a too intense cleaning of the oral mucous membrane. The first have long been known as Bednar's aphthæ, a term which by no means expresses any connection with aphthous stomatitis. Since the pain on swallowing renders the intake of food very difficult, a rapid removal of this affection is desirable. Any mechanical cleansing of the mouth by the nurse is to be forbidden, and on the ulcerating patches orthoform or a 2 per cent. silver nitrate solution is applied. Before feeding, the ulcers may be rendered insensible by touching them with a 1 per cent. cocain solution.

Noma.—In the course of various severe affections, especially measles, a rare but very fatal disease is sometimes observed, characterized chiefly by the occurrence of gangrenous ulceration of the cheeks; this gangrene is caused by an unknown germ and spreads very rapidly. The skin of the cheeks becomes colorless, shiny, and tight and the cheeks swell greatly. The gangrene spreads rapidly in the mouth

cavity; from the buccal mucous membrane it attacks the gingiva and the lips, being characterized externally by a dark discoloration of the cutis. The process heals by casting off the scabs, leaving defects in the cheeks and sometimes even a cicatricial closure of the jaws.

The danger of noma, to which most patients succumb, consists in the general septic infection, in the septic diarrheas, and the lobular pneumonia caused by aspiration of the putrid masses. In a great number of cases the disturbances in ingestion plays a great part, whereas in other cases the appetite, surprisingly, is not impaired. The greatest stress must be laid on ample nutrition; besides this, energetic local treatment, if undertaken in time, will be followed by success. This consists in cauterization with the Paquelin, in parenchymatous injections of a 2 per cent. carbolic acid solution, or best in the radical operation, extending far into the healthy tissue.

Angina Ludovici.—Phlegmon of the oral floor and of the neck belong here; thus the angina Ludovici, a term which comprises, nosologically, quite different affections. In cases with a severe infiltration of the oral floor and the region of the chin, a primary sublingual localization may be supposed. If compresses, wet with aluminum acetate, give no relief, surgical intervention will be indicated, consisting in incision from without, but not from the oral cavity (Delorme).

Inflammation of the Salivary Glands.—Epidemic parotitis and the analogous affections of the submaxillary and sublingual glands cause transient but considerable disturbances in nutrition. There exists thereby, a severe degree of spasm of the jaws which permits only of the supply of liquid foods. Angina with difficulty in swallowing may develop simultaneously.

It should be stated that the disease does not always take the light course in adults that we are accustomed to see in children. Beside different complications, whose discussion does not belong here, the hindrance to ingestion may become so obstinate and intense that even feeding by the nose may have to be considered.

Diseases of the Tongue.—Of great importance are diseases of the tongue.

Glossitis.—Acute inflammation of the tongue, with or without pus formation, causes constantly such violent pain that any intake of food becomes impossible. Glossitis may follow burns, cauterization, oral affections of different kinds, insect bites, etc., or may develop through extension of erysipelas from the nose or the cutis. The tongue may increase in volume so fast that it no longer has room in the oral cavity and appears between the lips. The danger of suffocation from edema of the glottis is of course much more imminent than

that of inanition. Ice-cold liquid food can almost always be taken. In light cases, disinfecting mouth-washes and catharsis will be sufficient; in severe cases scarification will be advisable to relieve the tension, even before fluctuation is present.

Tuberculosis of the Tongue.—Tubercular ulcers of the tongue are found in patients affected with pulmonary or laryngeal phthisis, but very rarely are primary. The diagnosis is sometimes only possible through exploratory excision or through microscopic examination of ulcerative particles for tubercle bacilli. Typical cases may be diagnosed clinically, for the base of the ulcer, covered with cheesy masses, the pale flabby granulations, the undermined margins, and the dissemination of miliary nodules in the circumference are very characteristic. Mastication increases the pain very much, and this renders the urgent indication for overfeeding tubercular patients quite impossible.

Syphilis of the Tongue.—Syphilitic manifestations are found on the tongue in the form of the primary affection, as well as of the secondary and tertiary. Through the breaking down of papular efflorescences, broad condylomata, and gummata there develop syphilitic ulcerations, characterized by a lardaceous coating, and often by multiple appearance. The purifying action of the antisyphilitic treatment, especially of sodium iodid, assures the diagnosis.

The pain of luetic affections of the tongue is not so severe that the intake of food suffers.

Leukemic Infiltration of the Tongue.—In leukemia, lymphomatous infiltrations of the tongue are observed not rarely, early becoming necrotic and ulcerous in character. Their point of predilection is the annulus Waldeyeri in the pharynx, formed of lymphadenoid tissue. In acute leukemia, gangrenous stomatitis plays a principal part in the clinical picture, whereas in the chronic form it scarcely disturbs the course of the disease. The nutrition suffers more from the tendency to hemorrhages than from pain on ingestion.

Carcinoma of the Tongue.—Passing over very rare diseases of the tongue, as actinomycosis, lupus, and leprosy, we turn to the most frequent malignant neoplasm, carcinoma of the tongue, from which men chiefly in advanced age suffer. In this age any nodule, vesicle, or fissure of the tongue has to be carefully observed. The well developed tumor may present itself as a papillary proliferation, as a scirrhus or as a deep pus-secreting ulcer. The last form is the most common one. The pain in cancer of the tongue is often so considerable that the patient dreads any intake of food, and in very extensive tumors which spread into the surrounding tissue, closure of the jaws may develop to such a degree that it may be relieved only by means of wedges placed between the teeth during deep anesthesia. The

act of swallowing also suffers, so that death from an intercurrent disease (aspiration pneumonia, sepsis, etc.) must be considered as the salvation from unbearable torments, combined with the impossibility to eat. In this last stage, feeding by sounds through the nose or through a gap between two teeth becomes necessary to save the patient from inanition. The treatment of cancer of the tongue is purely surgical. Prophylaxis is certainly of importance. In all persons who from heredity are predisposed to cancer, any stimulation of the lingual epithelium by alcohol, spices, tobacco, a carious tooth, etc., must be avoided. Any little benign ulceration must be strictly attended to; it should not be unnecessarily irritated by cauterization, and if of long duration should preferably be excised before it undergoes carcinomatous degeneration.

Other Specific Diseases of the Oral Cavity.—Not only on the tongue, but also on the lips may specific diseases be found, as the primary luetic affection and carcinoma; ingestion is not seriously affected thereby, but rather by diseases of the alveolar processes of the jaws, of the palatine arch, and of the soft palate. Sarcoma of the antrum may extend through the palatine arch into the mouth, and there undergo ulceration. On the soft palate tuberculosis is not as rare as was believed in earlier times (Isambert and B. Frankel).

Oral Affections in Hemorrhagic Diathesis.—The severe involvement of the gingivæ in scurvy is generally known, though an intimate connection between gingivitis and the other manifestations of scurvy does not necessarily exist. The oral affection may be completely absent in very pronounced cases of the disease and, on the other hand, very pronounced in slight cases if the care of the mouth is neglected, and especially if many carious teeth or roots are present.

The gums become spongy, lividly discolored, and bleed very easily; they send proliferations upon and between the teeth, and finally there result ulcerative processes on the gingivæ and the adjacent portions of the cheeks. Hemorrhagic infarcts may develop in the mucous membrane of the cheeks and gums. This involvement of the oral membranes may last many months longer than the other manifestations of scurvy. Considering that the treatment of scurvy consists, for the most part, in roborant nourishment, it is clear that we shall have to give special attention to the affection of the oral cavity. We try to avoid its development at the onset of the disease by extracting carious teeth and by removing the tartar.

Painting with tincture of myrrh, galla, and ratanhia, āā partes, with tincture of iodin, with a 1 per cent. solution of tannin, or of copper sulphate in equal parts of glycerin and water, cauterization with the silver-nitrate pencil, rinsing with disinfectant and astringent mouth-

washes, and numerous other remedies have been advocated. In somnolent patients the oral cavity is sprayed out with the head bent forward.

At times one sees in other diseases of the hemorrhagic group bloody infiltration of the oral membrane, with or without gangrenous decomposition. In the course of a rheumatic polyarthritis F. Kraus saw bleeding of the palatine arch and of the hard palate without a tendency to ulceration. There was difficulty on swallowing and the tonsils were enlarged.

In some hemorrhages from the oral cavity, in the hemorrhagic diathesis, the patient is in constant dread of provoking a new hemorrhage by eating. In such cases a form of diet must be chosen which neither mechanically nor thermically irritates the mucous membrane. In this way we will be able to supply the nouriture required for the bed-ridden patient.

Diseases of the Jaws.—Various affections involving the skeleton of the jaws inhibit the power of mastication, and in some even permanent closure of the jaw is prduced.

Fractures.—Fractures of the jaw, usually of the mandible, may be caused by trauma; the patient is then unable to eat. With forward luxation of the capitulum, the patient entirely loses the power of closing the mouth, holding it rigidly open.

Luxations.—In rare cases there occurs luxation backward in women; this leads to closure of the jaw. Suddenly it becomes impossible to open the mouth; later, with a snap, the movement becomes entirely free again.

Periostitis.—A severe disturbance of nutrition does not follow from these traumatic affections if they are rightly treated nor from the most common form of closure of the jaw, due to periostitis, developing from caries of the inferior molars or from the breaking through of the last molar.

Tumors.—Closure of the jaw may further be produced by malignant neoplasms which, taking their origin in the skeleton of the jaws, may form an ankylosis between maxilla and mandible.

Closure of the Jaws (Trismus) through Articular Diseases.—Involvement of the temporo-maxillary articulation in acute articular rheumatism is of very rare occurrence. In progressive chronic rheumatism, on the other hand, Garrod finds, in a statistic comprising 500 cases, an involvement of this articulation in a quarter of all cases. Especially in old toothless individuals this affection is said to be frequent; its course in middle age is much more rapid and painful.

In some cases not only deformative processes arise, which render chewing difficult and painful, but a veritable ankylosis may develop, rendering nourishment possible only by means of a sound through

the nose or between a gap in two teeth which, if not already present, must be produced by extracting a tooth.

Following influenza, a remarkable case of involvement of the temporo-maxillary articulation has been reported by Spitzy. Multiple joint affections appeared in a child of five years, involving the jaw, too, and led to such a severe nutritive disturbance that the child only with difficulty could be saved from inanition by artificial feeding.

Closure of the Jaws through Diseases of the Soft Parts.—Phlegmons, lymphadenitis, with involvement of the connective tissue around the glands, erysipelas, and cicatricial contractions, following burns and pathological processes, may have the same effect. Only the condition last mentioned causes a persistent disturbance of nutrition, which must be removed by plastic operation.

Muscular and Nervous Closure.—In the acute dermatomyositis and in trichinosis the muscles of mastication may be attacked to such a degree that ingestion suffers very much and must be restricted to liquid foods. Spasm of the muscles of mastication is very common in tetanus infection and in strychnin poisoning. Tonic and clonic cramps of the muscles of mastication are a transient finding in the febrile conditions of chorea, hysteria, and severe tetany, and during the epileptic attack. Isolated spasms of the masseters may be caused by a diseased condition of the motor portion of the trigeminus nerve, anywhere in its course from the cortical area in the lower part of the anterior central gyrus to its nucleus in the pons and on to the periphery. Apoplectic foci which irritate this path at some point sometimes lead to very obstinate trismus; inflammation of the meninges may bring about the same condition in a similar way.

At the onset or in the well-developed stage of bulbar paralysis and in tumors localized in the pons, irritation of the trigeminus nerve with masticatory spasm may be observed, as a case of Wernicke proves.

By irritation of the sensory nerves spasm of the masseters may be produced. As reflex zone the whole area of the sensory branches of the trigeminus must be considered. A cold is said to be sufficient to produce trismus, formerly designated under the term "rheumatic trismus." M. Bernhardt holds the opinion that these cases are due to hysteria or to a tetanus infection through a small lesion which at the time of the trism is already healed. At any rate, trismus is occasionally observed in trigeminal neuralgia, in carious teeth, following the extraction of a tooth, and in difficult dentition.

Trismus is characterized by the inability of the patient to open his mouth voluntarily; even passively, it is only possible to separate the teeth for a few millimeters by using force. If the spasm in-

volves the pterygoid muscles, too, the mandible, on asymmetric involvement, may deviate to one side. The masseter and temporal muscles may be felt as hard ridges. Unilateral spasms of the masseters or exclusive involvement of the pterygoid muscles is very rare. In the latter case there exists trismus. Romberg relates the case of a woman with epilepsy who at times could not open, and at others could not close, the mouth.

In persistent tonic masticatory spasm nourishment suffers so much that artificial feeding through the nose is demanded. Rectal feeding will scarcely be necessary. Spasm of the muscles of mastication, if lasting for months, does not threaten life immediately, but is sometimes the symptom of a fatal nervous disease.

The treatment of trismus naturally depends on the nature of the primary affection. If it is of reflex origin (caries of the teeth, intestinal parasites, etc.) the removal of the cause will give surprising results. Resection of a sensory branch of the trigeminus may become necessary under some circumstances. The use of vesicants on the neck and in the region of the articulation of the jaws and the application of Points de feu have been followed by good results in cases of hysterical origin.

C. DIFFICULTY IN SWALLOWING

The third and most important group of disorders of ingestion pertain to difficulties in swallowing. They may be localized in the pharynx or in the whole extent of the esophagus. The differentiation becomes possible by the decided statement of the patient that he is entirely unable to swallow or that he could swallow but that the food sticks at a certain place.

The real inability to swallow must be differentiated from pain on swallowing, which causes the patient to avoid swallowing, especially the swallowing of coarse food. Under certain conditions, the impossibility of swallowing occurs even in healthy individuals. Everyone who makes several swallowing movements, one after the other, notices that after the eighth or tenth time his pharyngeal musculature refuses to act. It is a very peculiar phenomenon that on anesthetizing the faucial mucous membrane by treating with cocain for ten to fifteen minutes, paralysis of deglutition develops. The severity of the trouble varies in different affections.

Angina Lacunaris.—Clinical Picture.—Whereas in the catarrhal form of angina severe troubles of deglutition are scarcely observed, in the lacunar form they may be present in the highest degree. This disease sets in like a severe infectious disease, especially in elder children and in adults in the first half of life. Sore throat and diffi-

culty in deglutition appear and the tonsils show a very characteristic picture. They are red and swollen, with white plugs in the lacunæ. Sometimes the latter extend over the openings of the lacunæ, become confluent, and form a layer. The coating does not extend beyond the tonsil; at most small white spots may be present in the follicles on the posterior wall of the pharynx. The general manifestations and troubles of deglutition usually improve considerably after a few days, but the coating may remain on the tonsils one or two days longer.

Trouble in Swallowing.—From this it follows that the troubles of deglutition do not need special attention in this condition. It is not possible to nourish these patients well, as their general condition is too bad and they vomit everything taken in. Ice-cold milk in very small quantities may be given and is usually retained.

Diagnosis.—The diagnosis of lacunar angina, now that we have methods for cultivating the diphtheria bacilli, is very easy. In lacunar tonsillitis usually only virulent streptococci can be cultivated of all the abundant flora which are found in cover-glass preparations made from the coating (Escherich).

Clinically, also, diphtheria may be excluded with all probability. In the first stage of diphtheria, when it appears as a follicular angina, the plugs resemble the nail-like form in stab cultures; *i.e.*, the plugs creep out beyond the orifices of the lacunæ from the very beginning. A violent onset, severe swelling of the tonsils, and high temperature, often exceeding 104° C., speak against diphtheria.

Angina Lacunaris Pultacea.—The coating, if removed with the forceps, feels tough, while in lacunar angina it is easily crumbled between the fingers. For this form with coherent patches, Escherich proposes the name angina lacunaris pultacea. On the tonsils, but also in the fauces and at the base of the tongue, white or yellow-white spots or clumps may develop from proliferation of the leptothrix buccalis (mycosis faucium leptothricia). An inflammatory reaction is rare in this condition, difficulties of swallowing and fever being almost never observed, so that if these symptoms are present some complication must be suspected. The disease is probably identical with the seborrhea of the follicular glands of the laryngeal mucous membrane which Stoerk has described.

Angina Purulenta.—A form similar to the lacunar angina is described by A. Fraenkel as purulent angina. A muco-purulent secretion exudes from the lacunæ in the form of drops which conglomerate at the lower part of the tonsils, covering the niches in which the tonsils lie. Microscopical examination shows a secretion free from fibrin and very rich in cells; also macroscopically it looks like pus owing to its yellow color. A. Fraenkel considers the staphylococcus pyogenes aureus the etiological factor.

Plugs of Secretion.—Sometimes one sees plugs which are characterized by the absence of any symptoms of inflammation, and may be removed by pressure, like comedones, or are expelled spontaneously. Besides other kinds of bacteria, one finds threads of leptothrix and sometimes deposits of calcium salts (tonsillar stones). Troubles of deglutition do not exist in this chronic, but entirely harmless affection.

Prognosis and Treatment.—The prognosis of follicular angina is almost always favorable, though it sometimes develops into a phlegmonous angina.

Stoerk scrapes the diseased mucous membrane with a 0.1 per cent. solution of sublimate or a 2 per cent. solution of carbolic acid, believing in this way that he shortens the duration of the process considerably. Besides this, gargling and warm poultices are used.

Angina Parenchymatosa.—Under parenchymatous angina one understands a severe tumefaction of the tonsils or of the peritonsillar tissue, usually terminating in suppuration. Each attempt to swallow is accompanied by such violent pain that patients are not able even to swallow the abundant saliva, preferring to let it flow out of the mouth. In the peritonsillar abscess the whole palatoglossal arch is usually strongly protruding, the uvula very edematous, but the tonsils apparently unchanged. The patient is unable to open the mouth wide; there exists an inflammatory closure of the jaws due to the periarticular edema. The pus usually accumulates above and outside the tonsils, sometimes between the tonsils and the anterior or posterior palatine arch. Peritonsillar abscess usually follows an acute affection of the tonsils, and is especially frequent after scarlet fever.

Diagnosis.—Marked protrusion on one side renders the diagnosis suggestive. To recognize whether pus is present the digital examination for fluctuation up and outward in the palatoglossal arch is necessary.

Therapy.—The treatment consists in incision of the purulent focus. Premature scarification is inadvisable, for such intervention at this period is very painful and scarcely gives any lasting relief; indeed, the pain may even increase after it. It is scarcely possible to check the process by the application of cold. Experience teaches us that in beginning suppuration moderate heat is preferable to cold. Gargling with warm infusions or light antiseptics will be of good service. If the incision is done at the proper time the discomfort may be much relieved in a few hours.

Faucial Diphtheria.—*Simple Fibrinous Form.*—The onset of faucial diphtheria in its simple form, localized in the pharynx, is not usually very violent. The children are pale, weak, ill-humored, and show a slight increase of temperature and difficulties on swallowing.

The diphtheric affection in adults has a similar onset. Inspection of the pharyngeal organs shows the following changes: the tonsils are slightly swollen, their mucous covering is reddened, moist, and shining where it is not changed by the characteristic membrane formation. Of similar appearance is the pharyngeal mucous membrane. The coating consists of a grayish-white or green-yellow mass, whose margins are sharply defined or pass gradually over into the mucous membrane. The coating is sometimes raised above the level of the mucous membrane, at other times embedded in it. Its configuration may vary, consisting of stripes and bands, irregularly indented patches, and thin or thick membrane-like formations which penetrate into the tonsils. The same coating may be seen along the palatine arches, on the walls and uvula, and in the niches between them. This sometimes very striking white braiding of the fauces, especially of the uvula, is very characteristic. On removing a small piece of the coating with the forceps and rubbing it between the fingers, the tough consistency of the fibrinous masses is apparent. Cover-glass preparations made from the underlying surface of the membrane show, on short staining with Loeffler's methylene blue, the characteristic nests of Loeffler's diphtheria bacilli. They are recognized by their club-shaped swellings at the ends, by the vacuoles in their bodies, and their piled-up arrangement. Culture on Loeffler's blood serum renders the diagnosis within twelve to twenty-four hours certain. The pain in the throat is sometimes very violent, especially if the regional glands behind the angle of the jaw participate in the inflammatory process.

Catarrhal Diphtheria.—By diphtheria one understands, in the sense of Bretonneau, an affection characterized by the formation of pseudomembranes, but often we find patients, usually adults, who complain of pain on swallowing and a general malaise, offering the exact picture of a catarrhal angina, yet on cultivation the disease proves to be a diphtheria infection. True diphtheria may also present the picture of a follicular angina.

Chronic Diphtheria.—Chronic diphtheria, too, is associated with difficulty in swallowing, though it is never of a severe degree. We consider diphtheria chronic if the tendency to form pseudo-membranes exists longer than three weeks. There are cases known in which it lasted fifty to sixty days and even longer. Blanquinque is wrong in his statement that chronic diphtheria shows no general symptoms and is not infectious. On the pale red mucous membrane of the faucial organs and on the posterior wall of the pharynx, gray or grayish-yellow membranes are seen disappearing in one place and appearing in another. This chronic form, in earlier days not rare, is scarcely to be observed since the introduction of serum therapy.

The nutritive disturbances in this condition are due to the decreased appetite and to the effects of the toxin. The difficulty on swallowing cannot be made responsible for the insufficient ingestion.

Septic Diphtheria.—Quite different is the rôle which septic diphtheria plays in regard to the disturbance of nutrition. This disease usually occurs only in children after the fourth year of life, and is due to an unusual virulence of the diphtheria bacilli or to a mixed infection with streptococci or anaerobic bacteria. Beside severe manifestations of intoxication, one finds in this form the affection spreading over the tongue, lips, and nose; moreover, the localization in the pharynx is of a peculiar typical nature. The coatings become discolored, grayish-green, or, by admixture of blood, dark brown. The whole pharyngeal cavity may be filled with foul-smelling, bloody, ichorous masses. The membranes have lost their tough fibrinous quality, they become greasy or crumbly, penetrating deep into the tissue. Not only the faucial mucous membrane, but also the soft palate, the posterior wall of the larynx, and the vocal cords may within a few days undergo necrotic degeneration; in rare severe cases, parts of the cheeks and gingivæ also. It is clear that in these cases ingestion of food is such a torment to the patient that he can only be fed by sounds.

Treatment.—In every case of diphtheria ascertained by bacteriological examination, the antitoxin therapy of von Behring should be introduced. To avoid manifestations of the serum disease, the use of a serum of high valency is advisable, containing from 400 to 500 antitoxin units in 1 c.c. The skin on the thigh, over the fascia lata and in the hypogastric region is cleaned in the usual way with soap, alcohol, and ether, and the serum injected with a sterile syringe.

In the simple diphtheria of children 1000 units will be sufficient, in adults 1500. In septic diphtheria 3000 units should first be given, and if the result is unsatisfactory it should be followed on the next day by the same amount. Aside from the favorable effect of the antitoxin on the general manifestation of the disease, its influence on the local condition is evident. Discolored membranes become, often even after twenty-four hours, pure white; they become raised from the underlying tissue and their margins sharply defined. In the next two to three days the coatings melt away, becoming smaller in every dimension, and finally disappear, or they become rolled together and are cast off. If the discomfort on swallowing becomes severe, cold boiled milk and fruit juice are given. The meals must be small but frequent.

Angina in Scarlet Fever.—Involvement of the tonsils is to some degree a regular symptom in scarlet fever, since with the exception of rare cases of extrabuccal invasion of the scarlatina virus the ton-

sils represent the place of entry and the primary localization of the disease.

We find erythematous angina, lacunar plugs, extensive membranes which clinically often cannot be distinguished from diphtheria, and sometimes a necrosis which, extending deep into the tissues, causes destruction of the soft palate and palatine arch. As these symptoms may last two or three weeks and longer in severe cases, the disturbance of nutrition in this time becomes a weighty factor. The condition is aggravated by the fact that the lips show numerous bloody fissures; this affection is perhaps still more frequent in severe measles. In light cases the use of gargles, as a 1/2 to 1 per cent. hydrogen peroxid solution, will be sufficient. If severe necrotic processes are present, the cleansing of the mouth by a syringe, the head being bent well forward, must be emphasized. Cool drinks, milk, lemonade, white wine diluted with equal parts of water, the yolk of an egg with sugar, etc., are given.

Moser's serum treatment, which has proved to be efficacious against the danger of toxic injury, according to reports from Escherich's clinic, fails in its effects on the local changes, as only by administration at the right time can it prevent the development of severe necrosis. In cases resembling diphtheria clinically, the differential diagnosis is rendered possible only on bacteriological culture. In scarlet fever, chiefly streptococci, in diphtheria, Loeffler's bacilli, will grow. A mixed infection with both germs is by no means rare, and therefore, in doubtful cases, one will not hesitate to inject antitoxin.

Angina Aphthosa.—Aphthous stomatitis is rarely primarily localized on the palatine arch, but if it is one sees yellow-white infiltrations which, later on, become transformed into ulcers with sharp bright red margins. Similar efflorescences on the tongue and lips prevent us from confusing the disease with diphtheria. If necessary, the culture will decide.

Stomatitis Ulcerosa and Angina Ulcerosa Membranacea Vincentii.—Angina Ulcerosa.—*Bacteriology.*—In regard to the differential diagnosis of diphtheria, not only lacunar angina and the angina of scarlet fever, but also another diphtheroid affection of the pharynx has to be considered; this commonly is called angina Vincentii, though the priority of the finding of the spirochetæ is due to Plaut (1894), as Eichmeyer has proved. Bernheim enlarged our knowledge of the etiology of this disease, proving that the same findings occur in ulcerative stomatitis. One finds fusiform bacilli: they are rods, thick in the middle with pointed ends, sometimes with a gap in the body, due to involution and not to spore formation. From this appearance they have aptly been compared with a shuttle (Bacille en navette). These

bacilli are Gram-negative and are highly motile, due to their long cilia. They are found not only in ulcerative angina, but also in noma, ulcerative stomatitis, and in certain forms of diphtheria which are characterized by greasy patches and a disagreeable fetor. In these cases Leiner has succeeded in obtaining a pure culture. These bacteria, occurring in the mouth as saprophytes, are found in great quantities in the cover-glass preparations of the diseases named. Together with these bacteria a delicate spirocheta (S. denticola) with numerous spirals is found, frequently in groups (Uffenheimer). They stain poorly in Loeffler's methylene blue, better in a somewhat diluted carbol-fuchsin solution. Escherich and Stooss often found in the coating in lacunar angina comma-shaped bacilli, spirochetæ, and rods, with pointed ends.

Clinical Picture.—Vincent's angina may present itself in two forms:

1. The croupous form. On one tonsil, somewhat swollen but intensely reddened, a yellowish-white or discolored pseudomembrane is found which is easily detachable from the underlying surface.

2. The ulcerous form (l'angine chancriforme). Deep-reaching tissue necrosis, with a greasy, pulpy coating, develops into a deep crater-like ulcer with dentated margins and rough base. At the same time there is difficulty on swallowing, increased salivation, and a very disagreeable fetor *ex ore*, and the local glands are swollen.

Diagnosis.—Diphtheria and lues have to be considered in the differential diagnosis. After repeated fruitless attempts to cultivate the Loeffler bacilli, diphtheria can be excluded. It must not be forgotten, however, that both diseases may be combined, so that the typical microscopical findings of ulcerous angina are by no means a cause for excluding diphtheria. Even in the coating on syphilitic ulcerations these bacilli may be found. We may suppose a pure Vincent's angina only when no staphylococci nor streptococci are to be found deep in the membrane.

The differential diagnosis is aided greatly by a consideration of the clinical course. According to Bernheim and Pospischill, beside the slight general symptoms, swelling of the glands of the region in a moderate degree and the discoloration of the coating to green or dirty brown, the fetor, and the deeply penetrating decomposition are factors speaking for ulcerous angina. This disease very rarely spreads to the palatine arch. In the primary luetic affection of the tonsils the severe swelling of the tonsils and of the glands at the angle of the jaw, in the secondary and tertiary manifestations other specific eruptions appearing simultaneously in the oral cavity or in other parts of the body are findings rendering the diagnosis of syphilis certain.

Prognosis.—The prognosis is always a favorable one, the period of convalescence, lasting usually only a few days, may sometimes continue about three weeks.

Treatment.—Gargling or rinsing of the pharynx is of great value in removing the swollen necrotic masses; of less value is chemical disinfection or cauterization. Chauffard and Siredey used, with good success, chemically pure methylene blue in powder form, applying it locally with a cotton sponge; they believed they were able to exclude lues *ex juvantibus.* Different authors praise the internal use of chlorate of potassium. Considering that even on doses permitted by the pharmacopeia intoxications have repeatedly occurred, one must be careful, especially in small children, of the dosage.

One may prescribe:

Rp. Kali chloric., 0.5–1.0 (!):90.0
Syrup simpl., 10.0
DS. One dessertspoonful every two hours.
Never to be taken on an empty stomach!

Stomatitis Ulcerosa.—Of ulcerative stomatitis we have already spoken in detail. We only wish to mention that the typical bacterial flora is a constant finding in severe cases with simultaneous involvement of the lips, cheeks, and tongue, and that even in cases restricted to the gingivæ it is rarely absent.

Chronic Infections, Oral and Pharyngeal Diseases as Hindrance to Swallowing.—*Tuberculosis.*—Tuberculosis of the oral and pharyngeal cavities is not of great importance as a cause of difficulty in swallowing. Though the tubercular infection of the tonsils is of greatest interest from the general pathological point of view, we scarcely ever find a case to be recognized clinically. On the oral and pharyngeal mucous membrane tubercular ulcers are sometimes observed, but on the tonsils there exists no tendency to ulceration. The tonsils, rather, are to be considered a place of passage on the path of the invasion of the organism. Pharyngeal tuberculosis is often very similar to the much more frequent luetic affection; the differential diagnosis depends often on the finding of bacilli or on the success of the syphilitic treatment. Tuberculosis of the palate and pharynx causes pain on swallowing, thereby rendering nutrition difficult. Since it occurs chiefly in the last stages of phthisis, it is on this account also of very unfavorable prognosis.

The treatment consists in cauterization with the Paquelin and in brushing the ulcers with a 4 to 5 per cent. carbolic-acid-glycerin, which has, too, an anesthetic action.

Syphilis.—Primary syphilis occurs on the tonsils, and indeed more frequently than was supposed in earlier times. Many cases

formerly considered as cryptogenetic lues (syphilis d'emblé) may be traced back to infection of the tonsils. The diagnosis is very difficult. Weeks may pass before the characteristic ulcer appears, with its round margins and lardaceous coatings, usually situated on one side of the tough, swollen tonsil. The ulcer usually penetrates far into the tissue and is surrounded by an annular infiltration wall. Difficulty on swallowing is usually present, though in a moderate degree, and only if the palatine arch is involved in the infiltration does it increase.

The primary affection is to be distinguished from the secondary, papular, and ulcerative processes by the very marked swelling of the glands, which is much less intense in the secondary stage in which other secondary manifestations are constantly present. Mucous papules (plaques muqueuses, opalines, hyalines) are to be found on the lips and cheeks, and also on the velum palati, causing pain not only on chewing, but also on swallowing.

One finds round or elliptical spots, varying in size from a lentil to a cent piece, of milk-white or grayish color, surrounded by red borders; they heal only after weeks under specific treatment, causing usually but little discomfort.

Gummatous processes occur frequently on the hard and soft palates, causing in the latter case discomfort on swallowing, especially on simultaneous syphilitic myositis of the musculi palato-glossi and palato-pharyngei. Even extensive adhesions of the soft palate or the base of the tongue with the posterior wall of the pharynx have been described (Mracek, Nichols).

Late syphilitic affections of the pharynx are very rare; the pain on swallowing is then so intense that patients can take only liquid or pappy foods, and these but slowly; and thus the prognosis of the primary disease is rendered very unfavorable.

New Growths in the Pharynx as Hindrance to Swallowing.—Tumors developing on the pharyngeal organs will, of course, lead to difficulty in swallowing; for instance, the strongly vascular goiters, which, growing around the larynx and pharynx, appear as doughy masses on the lateral and posterior walls of the pharynx. In these tumors, rich in vessels, hemorrhage occurs easily, and this increases the discomfort (pharyngeal hematoma of Stoerk). The operation, as that in pharyngeal angioma, is a very bloody one.

Tumors of the connective tissue, as well as epithelial neoplasms, may cause difficulty on deglutition. The same is true of lympho-sarcomatous tumors, which, in their initial state, may be mistaken for adenoid vegetations; but they grow very fast, reach considerable size, are of a tough consistency, and readily undergo exulceration.

The prognosis is unfavorable, since surgical and internal treatment (arsenic) give only temporary relief.

Retropharyngeal Abscess.—Retropharyngeal abscess is most frequent in the first three years of life. It develops from infection of a retropharyngeal gland, on the base of a diffuse infectious catarrh, as, for instance, influenza, or through infection of small traumatic lesions on the posterior pharyngeal wall or following an otitis.

The picture is very characteristic. Intense pain on deglutition causes the child to spit out any food forced upon him; the stiff, wry position of the neck, the characteristic bleating timbre of the voice, in the later course the pharyngeal stridor and mucous rattling are very common symptoms. The lymph glands in the neck are swollen and painful and fever is present during the whole process. On careful inspection, by pressing down the base of the tongue, so that the epiglottis becomes visible, we recognize a protrusion on the posterior wall of the pharynx. On digital examination we feel a movable gland or, if this has become fixed from periadenitis, a hard, tough infiltration. This begins to soften from its tip, and in advanced cases the whole gland is transformed into an abscess sac.

At first glance, the picture resembles laryngeal croup. Further, it must not be forgotten, especially in elder children and in adults, that caries of the cervical vertebral column may cause retroesophageal or retropharyngeal burrowing abscesses. If such a condition is suspected, the spinous processes must be examined for their sensibility to pressure. Albert, in his "Surgical Diagnosis," recounts how a child was once brought to him with symptoms of stenosis of the air-passages and how the stiff anterior flexion of the head led him to examine the vertebral column and the posterior wall of the pharynx, and how, instead of performing the intended tracheotomy, he had to open the abscess.

Prognosis.—The prognosis of the acute retropharyngeal abscess is, if treated appropriately and in time, a favorable one. If the suppuration has extended into other glands, the pus may burrow into the mediastinum or pyemia may develop.

Treatment.—The purulent abscess must be opened with a scalpel which is protected with adhesive plaster as far as its tip. Still better protection against injury to the neighboring organs is afforded by a dressing forceps with sharp points or a Lister needle-holder; these instruments, introduced into the abscess closed, are then opened (Monti). Immediately after opening of the abscess the head must be bent forward to prevent aspiration of the purulent matter. It is advisable to empty the abscess cavity by means of the index-finger wrapped around with gauze. This procedure must be repeated often in the days following, as the cavity refills with pus. The benefit of the operation is usually an immediate one and the discomfort on swallowing is especially relieved.

Difficulty in Swallowing in Diseases of the Ear.—With the physiological act of swallowing are normally associated changes in the auditory apparatus. Various authors have stated that during deglutition the Eustachian tubes open. Gellé has also found with graphic methods that the ear-drum moves on swallowing. First it moves inward, and then considerably outward. From this association of movements it is readily understood that pain on swallowing may be one of the symptoms of acute affections of the middle ear or of the Eustachian tube.

Anatomical Lesions of the Esophagus in General.—If anatomical changes of the esophagus are suspected to be the cause of difficulty of deglutition, we should palpate the organ as far as possible. Valuable information may be gained. We may find tumors, compressing the esophagus to varying degrees, according to their size and location; goiters, swollen glands, or esophageal diverticula, characterized by their varying degrees of fulness.

Passing of Sounds.—The sovereign method of examination in suspected esophageal affections is the passage of sounds. These may be made of English rubber or from whalebone staffs on whose ends olives of different sizes may be attached. The technique of introducing an esophageal sound differs from that employed in introducing a stomach-tube in this way, that the patient must bend his head backward. It is, moreover, better not to ask the patient to swallow, but rather to breathe deeply. In order to avoid the larynx the sound is introduced along the posterior wall of the pharynx. If it should get into the larynx, cyanosis, cough, and pain appear at once; in diseases where the larynx is anesthetic, only cyanosis. The murmur observed simultaneously with the movement of respiration when the air passes through the opening in the hollow sound is by no means proof, as the anxious beginner believes, that the sound is in the aerial passages, for even in the esophagus, but not in the stomach, variations in the respiratory pressure exist.

On suspicion of an aortic aneurysm compressing the esophagus, the passage of sounds is contraindicated, as there is danger of bleeding to death. Sounding is used in the examination for foreign bodies, esophageal diverticula, cicatricial strictures due to cauterization, burns, or luetic affections, for neoplasms in the walls of the esophagus or in the neighboring organs, and finally for nervous spastic conditions.

By using sounds of different calibers one may determine the degree and the location of the stenosis, the latter being controlled by measuring off its distance externally from the chin along the anterior chest wall. As a means of orientation the following measurements from the incisors are of value (Sahli).

Entrance of the esophagus, 15 cm.

Bifurcation of the trachea, about 25 cm. Cardia, about 40 cm.

With the olive sound one may also determine the length of the obstacle, by marking off on the sound the measurements obtained on entering the stricture and reaching its deepest point. In the same way, multiple stenoses of the lumen may be detected. On passing the sound certain occurrences of semiotic significance may be observed.

The obstruction shows sometimes a different behavior if examined at different times. This is easily explained in nervous conditions, the sound being at one time checked on account of the spasm and at others gliding readily into the stomach. Or, after a period of patient waiting, the spasm gives way suddenly and at the same movement the hindrance is removed. But even organic stenosis may be improved, as, for instance, in carcinoma of the esophagus, when from exulceration of the tumor the condition for passage becomes improved for a short time.

Above each stenosis there develops, moreover, a dilated region, and in this way it may happen that the sound does not always meet the obstacle in the same direction. A stenosis may be suddenly aggravated if particles of food remain lying above it, and, as in intestinal stenosis, obturation is added to stricture. Pulsating diverticula in the upper part of the esophagus are sometimes more, sometimes less filled. Goiters swell at times, as, for instance, during the menses, and the resulting compression will be felt with varying strength at different times. Pain on passing the bougies must be considered. It is localized in carcinoma, even before there is any stenosis; on the other hand, the pain of peptic ulcer in esophagitis, a rather rare condition, is diffuse.

Particles of tissue found in the openings of the sound deserve attention. By histological examination the diagnosis of carcinoma is assured; bloody mucus points to ulcerative processes of different nature; while in thrush of the esophagus, vegetations of the oidium may be found.

Percussion and Auscultation of the Esophagus.—Percussion and auscultation in diseases of the esophagus do not usually give very valuable results. In diverticula it can be shown sometimes that the tympanitic sound changes to a dulness after eating.

Hamburger and Zenker auscult the murmur of swallowing along the esophagus over the neck and back, to the left of the trachea and of the vertebral column. In stenosis of high degree the murmur on deglutition is found to be retarded, from the point of stenosis downward, or to be entirely absent. Meltzer has auscultated the sounds of swallowing which are due to the passage of food through the cardia, over the xyphoid cartilages. According to his statements one hears, normally, six to seven seconds after the act of swallowing, a long

murmur. This interval is explained by the fact that the masses swallowed, even if liquid, rest for several seconds immediately above the cardia; to this point the food is brought immediately (Meltzer and Kronecker). In insufficiency and paresis of the annular muscle of the cardia the liquid is thrown immediately into the stomach by the act of swallowing. Instead of the murmur due to the pressing through of the food, we hear a splashing sound.

Esophagoscopy and Radioscopy.—In cases difficult to diagnose we will have to make use of the esophagoscope, though this method is by no means easy and is a very disagreeable performance for the patient. In cases of suspected foreign bodies, or in other causes of stenosis, the X-ray examination is of inestimable value.

Examination of Regurgitated Masses.—It is important to know whether regurgitated masses have already reached the stomach or not. A proof that they have been in the stomach is the presence of HCl.

Diseases of the Esophagus with Disturbance of the Ingestion of Food.—Congenital Atresia and Stenosis.—Complete atresia of the esophagus as a congenital anomaly is a very rare condition. It occurs somewhat below the larynx or in the region of the bifurcation. The sound meets an absolute obstacle. Such children die, of course, after a few weeks, all treatment being impossible. If there exists a communication between the esophagus and the trachea, each attempt to take food is followed by an attack of suffocation which ceases only when the whole of the liquid swallowed has been regurgitated (H. Finkelstein).

There exists also a congenital stricture of the esophagus which renders swallowing difficult and causes, from birth, regurgitation in varying degrees according to the intensity of the stenosis. Congenital stenosis of the esophagus does not necessarily exclude a continuation of life. It is distinguished from the acquired strictures by the anamnesis as well as by the pathologic-anatomic structure. They do not consist of scar tissue, like the acquired ones, but represent an annular constriction, histologically entirely normal.

This congenital stenosis of the esophagus sometimes causes symptoms only after weaning, when the child begins to take solid food.

The prognosis of congenital stricture is a favorable one, since the treatment by passing bougies may be of lasting success, whereas in acquired cicatricial stenoses a return of the stricture must be expected (F. Kraus).

Diverticula of the Esophagus.—Of great importance for the pathology of deglutition are the esophageal diverticuli, especially the pharyngoesophageal pulsating diverticuli, which Zenker first

described in 1877. Their etiology is not quite understood. By some trauma is held responsible, being supposed to act at the point of transition from pharynx to esophagus; others blame a congenital muscular weakness of the posterior wall of the pharynx.

Symptomatology.—This condition develops gradually. Only when a veritable sac has been formed may symptoms of esophageal compression be expected. Slight dysphagia appears, the sensations of a foreign body, and later on a real difficulty on swallowing. If food has once become lodged in the diverticulum, its removal is not easy, since the wall of the diverticulum has no muscle layer, and therefore it may remain there for hours and days. There results, then, a pressure on the esophagus and a traction, which transforms the lumen into a slit. Symptoms of marked stenosis may result, leading at times to death by inanition. Solid food does not pass if the diverticulum is full. On the other hand, it must be remembered that the sac is most easily filled by liquids. The evacuation of the sac, after a few days, gives relief. Evacuation is brought about by compression, by the contracting muscles of the neck, by passive emptying of the sack in certain positions of the body, by manual aid on the part of the patient, or by the retching movements of the pharyngeal musculature.

Diagnosis.—The presence of a tumor in the region of the neck, which fluctuates and gives dulness on percussion, pain and hoarseness due to pressure on the recurrent nerve, and fetor *ex ore*, together with the pathognomonic disturbance of swallowing, speak with great probability for a diverticulum. On passing the sound, one sometimes comes into the diverticulum, sometimes into the stomach. The diagnosis can be made definitely by means of the X-ray, the patient having been given an emulsion of bismuth to drink.

Prognosis.—The prognosis *quo ad vitam* is not unfavorable. Some patients live for decades in a fairly good condition. As soon as pronounced symptoms of stenosis develop, however, the patient dies from inanition in a few years, if an aspiration pneumonia or perforation of the diverticulum with a purulent phlegmon does not cut off life prematurely.

Treatment.—The treatment consists in the radical extirpation of the sac, if possible, but if the strength of the patient is not sufficient, gastrostomy must be performed, for feeding neither by sounds nor by the rectum can prolong life for a long period. It is sometimes very difficult to pass the bougies, as they become entangled in the diverticulum. By having the patient take different positions, chiefly the lateral, one will succeed more easily. Merkel advises introducing a thinner sound into the diverticulum and a second one into the esophagus. To perform feeding by sounds in inoperable cases, the

diverticulum sounds of Leube-Zenker are used to great advantage. In less severe cases the patient must be admonished to eat very slowly and carefully, to take frequent and small meals, chiefly in purée form, and to find out for himself the position best suited to his needs. The diverticula due to traction are not associated with troubles of deglutition.

Inflammatory Diseases of the Esophagus.—Esophagitis is a rare disease. Only infrequently does it develop from progression of an inflammatory process of the oral, gastric, or laryngeal mucous membranes; rather it develops directly from mechanical, thermal, and chemical irritations of various kinds (foreign bodies, cauterization, too hot liquids). It is a secondary finding in scarlet fever, measles, variola, typhoid fever, and diphtheria.

The symptoms of esophagitis are usually so slight that the condition is overlooked if esophagoscopy does not render the diagnosis possible by the finding of a reddened and swollen mucous membrane. In severe cases of acute esophagitis, erosions and ulcers may be seen extending longitudinally; the patients complain of pain both independent of, and dependent on, the act of swallowing. They are able to swallow only liquids, and retch out the food or the secretion of the esophageal mucous membrane. Examination by sounds must be omitted in such cases. In nervous individuals a spastic condition of the muculature is sometimes associated with the inflammation. In the chronic catarrh of smokers and drinkers as well as in the congestive catarrh of cardiac and pulmonary diseases, dysphagia is not as a rule present.

Treatment.—The treatment of esophagitis will be, if possible, a causal one; foreign bodies must be removed, cauterizing acids and lye neutralized as quickly as possible by very dilute alkalies or acids; in congestion one will aim to improve the cardiac force, and prevent the abuse of alcohol and tobacco.

Symptomatically the swallowing of small fragments of ice, and of ice-cream (but not ices of acid fruits), the application of ice-bags at the back and on the sternum, and cupping on the neck, are advisable. Internally anesthesin may be tried; in severe pain, morphin or cocain. If the acute stage has passed, astringents are to be used. Schech recommends:

Rp. Acidi tannic,	1.50
Aq. destill.,	140.0
Glycerin,	110.0

DS. One tablespoonful every two hours.

Rosenheim introduces a sound covered with paste before meals, leaving it in the esophagus for a quarter of an hour, so that the paste

may melt from the body heat. The paste consists of cocoa butter with the addition of 3 to 10 per cent. of tannin or 2 to 5 per cent. of silver nitrate. Janowsky gives 5 to 10 drops of adrenalin (1–1000).

Ulceration of the Esophagus.—Peptic ulcers may arise in the inferior part of the esophagus, behaving like ulcers of the stomach. Farther, traumatic catarrhal, tubercular, and luetic ulcerations have been observed. In the peptic ulcers, bismuth emulsions may be tried. Tubercular ulcers may develop from the perforation of tubercular and caseous bronchial glands into the esophagus. Syphilis demands specific treatment.

Bleeding from Esophageal Varices.—In liver cirrhosis, hemorrhages from esophageal varices are frequently observed. The treatment is the same as for gastric hemorrhage; all intake of food is stopped at once. After the bleeding has ceased, ice cold milk is given. If we are sure that we have to deal with hemorrhage due to varices and not to hemorrhage from ulcers we may introduce the dilatation sound of Schreiber and let it lie like a tampon.

Infectious Diseases of the Esophagus.—*Phlegmonous Esophagitis.*—Circumscribed, purulent processes of the esophageal wall are occasionally met with, due to the suppuration of the mucous glands, the esophagitis phlegmonosa circumscripta of Chiari, which may develop into a diffuse phlegmonous inflammation of the esophagus. Foreign bodies, also, play an important rôle in the etiology.

Diphtheria of the Esophagus.—Faucial diphtheria leads much more readily to an involvement of the stomach than to an esophageal diphtheria. Even in severe cases, the membranes cut off sharply at the border-line between pharynx and esophagus, and only in very exceptional cases do they attack the latter. In the picture of the progressive faucial diphtheria extending to the respiratory passages, involvement of the esophagus plays no part, for difficulties on swallowing exist even in pure faucial diphtheria and in affections of the larynx.

Esophagitis in Small-pox.—In the exanthematic stage of small-pox, a variolar exanthem with the appearance of small ulcerations on the esophageal mucous membrane may cause difficulty in swallowing (E. Wagner); stricture, however, scarcely ever develops as a result of this disease.

Tuberculosis of the Esophagus.—The tubercular affection of the esophagus is very rare, and still more rarely recognized during life. It may have an entirely symptomless course, causing only slight difficulty on swallowing which, however, may reach a severe degree if extensive stricture develops.

Syphilis of the Esophagus.—Syphilis of the esophagus is, too, a rare condition, and is usually found in the tertiary period many years

after the infection, in the form of submucous gummata and diffuse infiltration of the mucous membrane, chiefly at a time when other luetic manifestations have disappeared, or in hereditary syphilis. Difficulties on swallowing set in only when the stricture is severe and have no special characteristics. The antisyphilitic treatment, which certainly always has to be instituted, comes too late if the stricture has once developed. If inanition threatens, feeding by sounds and gastrostomy are the only means left.

Actinomycosis.—The ray fungus may directly invade the wall of the esophagus through a lesion, or may attack it secondarily from without, in cervical actinomycosis. In some cases the disease spreads from the oral or pharyngeal cavity to the esophagus.

Trichinosis.—In trichinosis the striated musculature of the esophagus is involved, together with that of the pharynx, owing to the invasion of the muscle by the trichinæ. This probably is the explanation, too, of the difficulty on swallowing.

Thrush of the Esophagus.—Thrush is a very frequent and important disease, especially in the age of infancy. In adults, it occurs only on the base of severe general disease as typhoid fever, sepsis, tuberculosis, etc. In children, especially in infants, swallowing may be rendered completely impossible by the abundant vegetations of the oidium. Tuber-like or solid molds of the esophagus, consisting entirely of thrush vegetations, are retched out. The prognosis in these cases depends on the gastrointestinal disorders of the small patients. The treatment consists in forcing a passage through the esophagus by means of a stomach sound, and in the frequent administration of a 2 per cent. solution of boric acid in small quantities (1/2 teaspoonful every two hours).

Carcinoma of the Esophagus.—Carcinoma of the esophagus is observed chiefly in males of advanced age. It is almost always primary, in rare cases being due to extension from neighboring organs, practically never to metastases. Only in exceptional cases does it appear before the fortieth year of life, as in a case nineteen years of age of Heimann.

Dilatation and hypertrophy develop above the stenosis. The tumor may be located at any point from the entrance of the esophagus to the cardia, but the height of the bifurcation of the trachea is a place of predilection (Klebs, v. Hacker).

The *symptomatology* is as follows: Disorders of deglutition begin gradually at first, and then increase. The patient feels as though a too large or a not sufficiently insalivated mass of food sticks at a certain place. A drink of water removes this discomfort at first, but gradually it augments, the patient is obliged to masticate the food very long, and finally can take only liquids. Emaciation progresses

very rapidly in these cases, and reaches a most severe degree. The patient indicates constantly a certain point which may not necessarily accord with the localization of the cancer, but may be higher, where the hypertrophied musculature is in a state of spastic contraction, analogous to the intestinal rigidity (darmsteifung) above an intestinal stenosis (Rosenheim). The food taken in is soon regurgitated.

It is a remarkable fact that in the beginning of the affection even thick sounds (*e.g.*, 10 mm.) may be passed without difficulty, while the food already meets with a considerable obstacle. Between the mechanism of introducing bougies and of swallowing there is, however, a great difference, as Martius and Reuffurth made clear by the following comparison. Into a doughy mass one may introduce a stick deeply by continual slight pressure, whereas a stone thrown even with great force will not penetrate very far.

The *prognosis* of carcinoma of the esophagus is a very sad one. The patients usually die from inanition, if a perforation into the aerial passages or into the big vessels does not end their suffering. In general, the condition lasts half a year after the diagnosis has been made.

In *treatment* of carcinoma, extirpation of the neoplasm is possible only in a few cases, since in scarcely a tenth part of all cases is it localized in the cervical region, accessible to the knife of the surgeon. In high-seated, inoperable tumors, an esophageal fistula may be made (esophagostomy), but this has no advantage over gastrostomy. Statistics teach us that even with gastrostomy, the duration of life cannot be prolonged much, though any direct irritation of the carcinoma by the food is thereby eliminated. Feeding by the natural ways must be tried as long as possible, through the right choice of food; thus sweet-breads, brain, hash and meat jellies, egg-nogs, puddings, creams, condensed milk, soup with somatose, nutrose, or eukasin, etc., are given. Carefully performed treatment by sounds may be of good service for some time, though it cannot be denied that the growth of the carcinoma and its exulceration may be stimulated by it.

F. Kraus, an unquestionable partisan of the sound treatment, believes that perforation will certainly occur much more frequently with this treatment than is reported in the literature. He considers the danger of perforation due to decubitus, produced by the permanent cannulæ which remain in the esophagus for weeks and months, still greater. In carcinoma of the cardia, Schiele introduces a drainage-tube through the stricture by means of a mandrin and attaches a string to it in order to change it easily. v. Hacker uses thermocauterization or the galvanocaustic loop under guidance of the esophagoscope.

Five to ten drops of adrenalin takamine (1 to 1000) gives some transient relief, decreasing the inflammatory swelling of the tumor.

Other Tumors of the Esophagus.—Beside carcinoma—the most frequent neoplasm of the esophagus—papillomas, fibromas, lipomas, myomas, sarcomas, cysts, and, very rarely, dermoid cysts, occur (F. Kraus). All these tumors, especially the fibromas, may be pedunculated, and then they produce, beside the disturbance to deglutition, attacks of suffocation by obturating the *aditus ad laryngem.*

Cicatricial Strictures.—All ulcerative processes, above all cauterization with lye, may lead to severe cicatricial stricture of the esophagus, which may be improved by the passage of bougies. The prognosis is better in children than in adults, for one may expect a certain compensation through development of the child. So it is a fact that more than 50 per cent. of cases terminate in recovery. On the other hand, it must be mentioned that phlegmonous esophagitis and even perforation may follow the treatment with sounds, that tubular strictures give a bad prognosis, and that the possibility of a relapse must constantly be borne in mind.

One uses elastic bougies, first of conical, then of cylindrical form. If the stenosis is very marked the passage may be found by the shoving forward of gut strings, lying in a hollow bougie (Finkelstein). The bougie treatment may be begun the third week after cauterization; the sounds are first left in place for fifteen minutes, later on for thirty minutes. This treatment, which lasts about six months, may be aided by injections of thiosinamin or fibrolysin, when the inflammatory symptoms have disappeared. If the passing of sounds through the mouth is impossible, esophagostomy and gastrostomy may be performed.

Diseases of the Larynx Causing Dysphagia.—Since the larynx, *in toto*, moves during the act of swallowing, all acute diseases of the larynx are associated with hindered or painful deglutition. If the arytenoid cartilages and the epiglottis are affected, the pain will be very severe; this results from the function of these organs, during the act of swallowing; the base of the tongue is elevated, the larynx sinks under it, and between both lies the epiglottis over the entrance to the larynx (Stoerk). The participation of the epiglottis is, in many cases of laryngeal affections, the direct cause of the dysphagia, as for instance in laryngeal diphtheria, in which the free margin of the epiglottis may be found reddened and covered with a fibrinous exudate.

Angina Epiglottidea.—There exists an inflammation limited to the epiglottis, the angina epiglottidea of Albers. This condition sets in with slight fever and dysphagia, soon followed by severe, spontaneous pain, by very severe pain on deglutition, and by swallowing

into the larynx. On the laryngoscopic examination the epiglottis is seen considerably swollen and inflamed, with some superficial loss of substance, and covered with a grayish-white coating.

The prognosis is usually favorable on proper treatment. But aspiration pneumonia or general sepsis may render the condition fatal. The patient should inhale a 1 : 1000 solution of morphin or a 1 to 3 per cent. solution of alum every hour; Leiter's cooling apparatus may be applied over the neck.

The very much dreaded erysipelas may, in some stages, bear a certain similarity with this affection.

Fractures of the laryngeal skeleton and perichondritic processes as in the course of typhoid fever, cause, too, in the beginning, trouble on swallowing. They will have to be treated with antiphlogistic measures, and if an abscess is present it will have to be opened.

Laryngeal Tuberculosis.—Tuberculosis attacks the larynx only secondarily, appearing in different clinical forms, as miliary nodules, ulcers, tumors, diffuse infiltration, or in a combination of these forms. With the laryngoscope one sees swelling of the mucous membrane on the internal posterior wall of the larynx, and on the interarytenoid intumescences; farther, infiltrations and exulcerations on the true and false vocal cords, on the epiglottis, and on the aryepiglottic folds. The epiglottis may sometimes be entirely destroyed by ulceration and necrosis.

The pain on deglutition in this disease is very great if the arytenoid region is infiltrated. In such cases introduction of the stomach tube is very painful, unless one follows the advice of Stoerk, introducing it carefully into the esophagus under guidance of the laryngoscope, past the side of the infiltration through the pyriform sinus.

Owing to the urgent indication to nourish tuberculous people abundantly, the disturbance of deglutition is a dangerous complication, which renders still more unfavorable the prognosis of laryngeal phthisis.

The treatment consists in surgical intervention, galvanocauterization, cauterization with lactic acid, and sunlight radiation, which Sorgo recommended. The patient, standing before a mirror, directs the ray of sunlight into his larynx by means of the laryngoscope. The pain on swallowing demands careful treatment in order to render sufficient nourishment possible. Insufflation of orthoform immediately before meals sometimes renders good service. A. Jaquet brushes the swollen ulcerated parts of the mucous membrane with a 10 to 20 per cent. oily solution of acetochloroform, thereby accomplishing relief from the pain for some hours. Lotheissen speaks well of insufflation with anesthesin, and brushes the painful parts with a 1/2 per cent. solution of it, and with adrenalin. Bramesfeld uses

a 10 to 20 per cent. solution of lignosulphate locally. Cocain and, in severe cases, morphin will have to be resorted to.

Syphilis of the Larynx.—Syphilis may affect the larynx in different ways, causing dysphagia. Simultaneously with the first eruption of the secondary manifestations, a catarrh of the mucous membrane of the epiglottis and of the larynx may develop. Papules and diffuse infiltrations are not infrequent on the epiglottis and on the ary-epiglottic folds; farther, gummas and specific perichondritic processes, the latter on the lateral plates of the thyroid cartilages, on the cricoid cartilage, on the epiglottis, and on the arytenoid cartilages. In the last two cases they cause violent dysphagia, while in the first-mentioned cases very dangerous attacks of suffocation appear, demanding tracheotomy.

An energetic antisyphilitic treatment combined with local therapy often gives, in such cases, surprisingly good results; cicatricial stenosis is often not to be avoided.

Carcinoma.—In carcinoma of the larynx, which renders deglutition difficult, no time must be lost in endolaryngeal forms of treatment, but the extirpation with the formation of the laryngeal fissure must be performed as soon as possible. In the same way we will treat the much rarer sarcoma of the larynx.

Nervous Diseases Causing Dysphagia.—In diseases of the nervous system, two forms of dysphagia may be distinguished; swallowing may be impossible, owing to nervous disorders of various kinds, and the dangerous tendency of "swallowing the wrong way" may exist. On account of the possibility of an aspiration pneumonia in the latter case, one will abandon the usual way of nourishment by the mouth even if the necessary quantity of food could be supplied in this way. The diseases leading to a disturbed condition of the reflex of swallowing are numberless. The sensory track courses in the palatine and pharyngeal ramifications of the second branch of the trigeminus nerve, the motor track in the fibers of the vagus. Through a diseased condition of this arc and of that portion of the track which lies in the medulla oblongata and the pons (fibræ arcuatæ internæ), paralysis of deglutition may be produced. In the same way, spasm may hinder the act of swallowing.

The internal branch of the accessory nerve contains the motor fibers of the vagus. Its disease causes paralysis of the constrictors of the pharynx without anesthesia of the pharyngeal and laryngeal mucous membrane, whereas affection of the vagus trunk causes complete motor and sensory paralysis (v. Leube). The fact that dysphagia occurs not only in diseases of the medulla, but also in those of the pons, is explained by the injury of the cerebral tracts for the vago-accessorius and hypoglossus. The tongue plays an important part

in the voluntary act of swallowing, and therefore glossoplegia will cause a considerable disturbance of deglutition.

It is impossible to consider here in detail the semiotic of the bulbar symptoms-complex. A diagnosis is certainly only possible when we consider all findings of the nervous status.

The disturbed nutrition and the danger of aspiration pneumonia may be avoided by the use of sounds. At the same time, the act of mastication suffers by involvement of the motor fibers of the trigeminus and hypoglossus, which, through movements of the tongue, regulate the formation of the bolus.

Occurrence of Dysphagia.—Bulbar symptoms are found, first, in the progressive amyotrophic bulbar paralysis which usually begins with disturbance of speech (v. Leyden). Particles of food remain between the tongue and the epiglottis, in the pyriform sinus, get into the nasal cavity and larynx, or fall out of the mouth. Complete paralysis of deglutition is usually also found in acute bulbar paralysis, *i.e.*, in the softening and apoplexy of the medulla oblongata, in the acute hemorrhagic bulbar myelitis, in the traumatic affections of the medulla oblongata or in those caused by compression (spondylitis of the atlas or epistropheus, tumors, aneurysm), and in the acute neuritis of the bulbar nerves.

Also in the course of severe acute infectious diseases, as abdominal typhoid and sepsis, bulbar symptoms may occur. The postdiphtheric paralysis must be mentioned here, which usually sets in with paralysis of the velum palati; if it is fully developed liquids are regurgitated through the nose, and even get into the larynx; coughing spells occur during ingestion. This condition absolutely demands nourishment by sounds to prevent aspiration pneumonia.

Hysteria.—Of special interest for the differential diagnosis of organic disorders of deglutition are the tonic spasms of the pharyngeal and esophageal musculature in hysteria, which P. Richer has compared with hysterical contractures. It is a noteworthy fact that in hysteria liquids are more difficultly swallowed than solid food, and that any distraction of the attention, and suggestion, improve the ailment in a short time. In childhood and also in puberty this spastic condition of the esophagus is found, together with nervous anorexia and hysterical vomiting. The sensation of a lump (globus hystericus) is a symptom which has long been ascribed to hysteria. It is a very constant manifestation in hysterical women, in 400 cases only thirty being free from it (Briquet).

Tetanus; Lyssa.—The spastic form of dysphagia is also seen in tetanus and in lyssa. In the latter disease the sight of water may be sufficient to incite pharyngeal spasms (hydrophobia).

Pseudolyssa.—Similar conditions may occasionally be found in

nervous persons bitten by healthy dogs in the expectation of an outbreak of hydrophobia.

General Treatment of Nervous Dysphagia.—According to the spastic or paralytic nature of the disturbed deglutition, sedatives or strychnin will be indicated. In hysteria a suggestive therapy will be sufficient (tincture of valerian, the faradic current, etc.).

General Remarks.—The systematic provocation of swallowing movements, in some cases very important, is only possible with the galvanic current, not with the faradic. The anode is placed on the neck and, with the labile cathode, one brushes rapidly the lateral part of the larynx; on closing of the cathode and opening of the anode the movements of swallowing appear most easily (Erb).

In paralysis of the soft palate the velum may be treated directly with the faradic or the galvanic current; also the pharyngeal musculature may be directly stimulated by the laryngeal electrode, and the medulla oblongata may be reached by stabile weak galvanic current, the electrodes being applied in front of the ear, directing the current through the fossa auriculo-temporalis.

Dysphagia in Psychosis.—In mental diseases one sometimes has difficulty in combating the obstinate refusal to take food. This may be caused by disorders of digestion or by illusionary ideas, hallucinations, etc. (v.Krafft-Ebing).

For some days one may try to feed the patient with a beak-shaped cup. Care should be taken to maintain oral asepsis and the strength should be conserved by rest in bed. If after a few days the *sitophobia* has not ceased, forced feeding must be instituted. A tube of soft vulcanized rubber is passed through the nasal openings into the stomach, and luke-warm milk, bouillon with egg, wine, etc., is introduced. This procedure is repeated twice a day, and after abstaining from natural feeding for a long time, the patient should be brought back to it very gradually with small quantities of nouriture.

Difficulties of Ingestion: Operations on the Organs of Ingestion.—In operations on the organs of the oral or pharyngeal cavities, as staphyloraphy, cold boiled milk may be tried or we shall have to take refuge in feeding by sounds or by nutrient enemas. The same holds true for injuries of the neck, especially if the esophagus itself is involved. Exact advice about feeding is especially necessary in two surgical procedures—in esophagotomy and in laryngectomy.

Esophagotomy.—In the first operation the method of feeding to be adopted depends upon whether the fissure in the esophagus is left open permanently or whether it is sewed up again. In the first case the sound must be used for feeding, but not in the latter, as it may irritate the suture.

Laryngectomy.—After total extirpation of the larynx, nourish-

ment may become difficult under some circumstances, though through the modification of Bardenheuer the difficulties have been greatly lessened, since it is now possible to accomplish a good closure of the wound toward the pharynx. In this way within a few days after the operation spontaneous swallowing becomes possible, and the wound is not infected by the food. If spontaneous swallowing is not possible a permanent cannula or the usual method of feeding by sounds are to be considered. The latter will, in general, be preferred since in the lumen of the permanent esophageal tube the nutrient liquids easily undergo decomposition.

Tracheotomy.—An insufficient act of swallowing may develop after tracheotomy and intubation, especially in very small children affected with severe diphtheria. The feeble muscles of the larynx are unable to raise the larynx heavily burdened by the cannula or tube. One sees, then, in tracheotomized children that the milk taken appears in the cannula with coughing spells and that intubated children respond to each act of swallowing by a weak cough.

In such cases one may first try to give, in the place of milk, which offers such an excellent culture medium and causes the severest aspiration pneumonia, a homogeneous pap. Red-wine soup is cooked with arrowroot and sugar to a rather thick consistency, and this food will often be taken without strangling. If we do not succeed in this way, feeding by sounds remains, or, if the repeated introduction of the sound excites the child, by a permanent esophageal tube. Rectal feeding must be considered as a last resort, though in small children it gives much worse results than in adults.

Operations on the Stomach.—Some surgeons are very much reserved in regard to feeding by the mouth after operations on the stomach. Czerny and Rindfleish in 1892 made the following statement: "In operations on the stomach patients are best nourished by nutrient enemas for eight days. A teaspoonful of cold tea or a few drops of cognac in ice-water or rinsing of the mouth with lemon juice in water will quench the thirst. Even in the second week these patients receive only liquid, in the third week easily digestible food in soft form." v. Eiselsberg, on the other hand, uses nutrient enemas only exceptionally. He gives milk per os very soon, and even on the fourth and fifth days soft foods. At present, the surgeons show a greater tendency, in these cases, to favor more ample nourishment.

ADDENDUM

(*Extrabuccal Nutrition*)

The extrabuccal methods of feeding of which we have spoken so frequently in the previous chapter will here be described more in detail.

There are two kinds of extrabuccal nourishment which are

sufficient to protect a patient for some time against a too great loss of body substance, in cases where the natural ingestion is hindered or not advisable.

1. **Nutrient Enemas.**—Most frequently we make use of nutrient enemas, more rarely of subcutaneous injections of nutritive substances. Of course, both methods may be combined.

The method of giving nutrient enemas is a very old one, but their composition was inappropriate because the knowledge of the digestive function was unknown. Since we know that the digestive faculty of the mucous membrane of the rectum and colon is a very low one, we can expect results only from the use of such nutrient material as can be directly resorbed by the mucous membrane. For this purpose milk, meat juice, raw eggs, sugar solutions, wine, peptone, and fat in small amounts will be the proper substances.

Proteins.—The protein bodies, even in their native state, may be resorbed by the intestinalmembrane, but only in very small amounts, whereas the first putrefaction products of the proteins, the albumoses and peptones, are absorbed more quickly, and therefore are not so readily subject to decomposition. The investigations of Ewald have shown that egg enemas lead to the deposition of nitrogen, and in this way are by no means inferior to the peptones. v. Leube considers the manufactured preparations of peptone as very appropriate nutrient substances for rectal feeding, since they contain only soluble albuminous substances, albumoses, and peptones. The greater tendency of eggs to putrefaction, as compared with these substances, is sufficiently proved by the odor of the fecal matter evacuated. v. Leube has examined the excrement evacuated six to twenty-four hours after peptone-water enemas and found them free from albumoses and peptones, whereas proteins of higher composition would still be detected in them. No albuminoses were found in the excreted urine.

If too concentrated peptone solutions are given or in too large quantities, they are not retained by the rectum. Indeed, diarrhea may directly be produced. In general the dose of 50 gm. peptone (Kemmerich) to 250 gm. water is not to be exceeded. Also an egg enema of 2 eggs to 200 gm. milk and 2 gm. salt is well tolerated. Through putrefaction, however, they lead to irritation of the rectum if used for too long a period. It is therefore advisable to wash the intestine six hours after giving the enema to remove the decomposed residue. v. Leube never observed albuminuria following such enemas.

Carbohydrates.—Of carbohydrates, grape-sugar has to be first considered. If used in too concentrated solution, it produces hyperemia and the secretion of mucus and increases peristalsis. It is therefore advisable to inject only a 10 per cent. solution, for in higher

concentrations the enemas are spontaneously expelled. Glycosuria has not been observed, from which one may see that the entire quantity of sugar resorbed has passed through the portal vein, and that it has reached the vena cava by way of the inferior hemorrhoidal vein (S. Schörnborn and Leube).

More appropriate than sugar is amylum, whose saccharification occurs slowly, so that no irritating effect is produced. Starch enemas are, in fact, known as a means of soothing irritation in the treatment of rectal and colon catarrhs. Dextrin renders the same service, the greatest part of it being resorbed as sugar; 50 to 100 gm. amylum is given to 300 gm. water.

Fat.—The high calorific value and nonirritating action of fat would have recommended it for nutrient enemas, provided that the rectal mucous membrane possessed the ability to absorb it. This resorption is very low, and Voit and Bauer, in 1869, denied it entirely. If the fat is introduced into the rectum in the form of an emulsion and left there for a long period, a resorption of several grams in the course of a day may be observed.

Quite different is the faculty of resorption if at the same time a steatolytic ferment is brought into the rectum, as, in accordance with v. Leube's proposition, pancreas substance. By this modification it is possible to incorporate considerable quantities of fat (up to 50 gm.) with good results.

Enema of Pancreatic Substance of v. Leube.—At the same time the tryptic effect of the pancreatic ferment will develop its action, and with this in view v. Leube adds finely hashed meat to the pancreas substance. Metabolism experiments show that almost the whole nitrogen and a great part of the fat are resorbed by this method, though it must be conceded that the fat resorption is sometimes deficient; 150 to 300 gm. meat, 50 to 100 gm. pancreatic substance, and 30 gm. fat are finely divided, mixed, and introduced into the rectum.

The addition of starch has not proved successful, according to v. Leube, probably because the sugar-transforming action of the pancreas is so intense that in a short time a too concentrated sugar solution is produced, causing irritation.

This first rational method of rectal feeding has the objection of being too complicated, and certainly it is not always easy to get a fresh active pancreas.

Modification of Dobell.—Dobell, therefore, recommends the following modification:

Rp.	Meat, boiled and scraped,	90.0
	Boiled arrowroot,	15.0
	Emulsion of pancreas,	15.0
	Pancreatin powder (Savory and Moore),	1.2
	Pepsin,	1.2

This mixture is digested with warm water to the consistency of syrup, and 1 tablespoonful of brandy added.

Ewald's Enema Recipe.—Quite simple is the preparation of nutrient enemas, according to Ewald's prescription. Therefore, Merkel and Penzoldt advise trying those first, and only if they fail returning to v. Leube's method.

Ewald has 2 to 3 eggs well beaten with a tablespoonful of cold water. Then a knife-point of wheat flour is boiled with half a cup of a 20 per cent. grape-sugar solution, and a wine glass of red wine added. After the solution has so far cooled off that egg albumen does not coagulate in it, the beaten eggs are slowly added. It is very good to add 1 tablespoonful of peptone to this mixture.

Rosenheim's Enema.—Rosenheim uses 1 to 2 tablespoonfuls of peptone, 15 gm. grape-sugar, and an emulsion of cod-liver oil in a 0.3 per cent. soda solution to which 2 to 3 tablespoonfuls of cod-liver oil are added. The total quantity should not exceed 250 gm.

Calorific Value of Nutrient Enemas.—v. Leube calculates the following calorific values for his enemas.

1. Peptone-milk enema (250 gm. milk plus 60 gm. peptone)—270 calories.

2. Egg-milk enema (250 milk plus 3 eggs plus 3 gm. salt)—360 calories.

3. Starch enema (60 to 70 gm. starch plus 250 gm. milk)—420 calories.

4. Sugar enema (60 gm. grape-sugar plus 250 gm. milk)—420 calories.

5. Pancreas enema (75 gm. pancreas substance plus 225 gm. meat plus 37.5 gm. fat, as an average)—650 calories.

For the selection of the enema the calorific value should not be decisive, as the resorption of the same enema in different patients is very different; the nonirritating action, and therefore the possibility of retaining the enema, is of greatest influence.

Since, therefore, we are scarcely able to cause more than 500 calories to be absorbed in a day, we must constantly bear in mind that the patient by rectal feeding covers only a small part of his calorific requirement. However, if we individualize in the choice of the enema and persist in spite of an initial intolerance, we will obtain satisfactory results.

Technique of Application.—In order to succeed in rectal feeding, the technique is very important. A thorough cleansing of the rectum and the neighboring parts of the large intestine with about 1 liter of luke-warm water must precede the enema. Naturally we must often wait some time for the complete emptying of the water. For an intestinal tube a stomach-tube smeared with vaselin is best,

introduced as far as possible into the rectum. The patient lies on the left side, the knees drawn up against the abdomen or he may be in knee-elbow position. For thin fluid enemas, a funnel at the end of the rubber tube, held out 1 meter above the level of the patient, will be sufficient. In thick fluid mixtures an enema syringe will be necessary.

In order to accomplish a sufficiently long retention in the rectum, the enemas should be of thick, liquid consistency, not too voluminous, of a temperature of 38°, and introduced very high into the intestine and at the same time very slowly. If, in this way, the patient is not able to retain the enema, a suppository containing 0.03 gm. of laudanum or an injection of morphin may be tried before its application. The addition of 5 to 10 drops of opium or the omitting or decreasing of certain constituents of the enema which excite peristalsis, as alcohol, sugar, and salt, will be advisable. If nourishment per os is absolutely infeasible, two to three nutrient enemas *pro die* must be given; otherwise one will be sufficient.

Nutrient Enemas in Children.—The rectal feeding in children is usually less successful than in adults. In infants one gives 10 to 30 gm. four to five times a day, in older children as much as 100 gm. three times a day. Milk with some sugar, alcohol, and salt are the best constituents.

Thirst and Analeptic Enemas.—The supply of water in hindered ingestion is usually more important than the food supply. Instead of physiological salt infusions, 1/2 liter of luke-warm water with 1/2 teaspoonful of salt may be injected two to three times a day.

Riegel begins with smaller doses and gradually increases them. Of good effect are the intestinal injections recommended by Fleiner, consisting of two parts of broth and one part of white wine (not sour).

2. **Subcutaneous Ways of Feeding.**—The subcutaneous supply of nutrient material was first tried in 1869 by Menzel and Perko in Billroth's clinic in Vienna, but v. Leube deserves the credit of having built up this method into a useful dietetic measure. In presenting the present status of the question we shall follow chiefly the summary article of Battistini (Turin) which appeared in the *New Therapy*, IV, No. 9.

The three classes of foods have been used in subcutaneus feeding:

Proteins.—In regard to proteins we must demand that they are easily assimilated, without producing toxic effects or any irritation of the tissues. Peptones, therefore, which are rapidly resorbed, but at the same time are strongly toxic, have to be completely abandoned, whereas albumoses by their slow resorption produce intoxication less

readily. Native albuminous bodies cause those manifestations which when produced by the incorporation of proteins of another species in any extraoral way are known as serum disease.

In a case of uncontrollable hysterical vomiting Battistini has, with good success, made use of the injection of the yellow of egg which Picto and Kruel had previously tried in 1869. Bayle reports good results from it in severe phthisis. The technique is very simple. The yolk of the egg is, under sterile conditions, placed in physiological salt solution. In this way 2 to 3 yolks may be injected every day, but not more than 4 c.c. at the same place, as otherwise induration may be produced. In general, it must be admitted subcutaneous feeding with proteins has never been of practical importance.

Carbohydrates.—The subcutaneous introduction of carbohydrates is possible. Voit found that only after 60 gm. of dextrose has been given does glycosuria appear, and that even a liter of a 10 per cent. solution of dextrose may be incorporated if slowly infused. Lilienfeld has proved that intravenous injections of dextrose also are to a certain degree resorbed.

Cane- and milk-sugar are not appropriate for subcutaneous application, only dextrose. This may be given in a 5 per cent. solution in physiological salt solution in daily doses of 50 gm.; while by this means no considerable number of calories are introduced, the body nevertheless receives fuel which is easily resorbed and oxidized, and which is of especial value for the nourishment of muscles. Sugar is therefore an excellent food in manifestations of fatigue, especially in weak labor pains. v. Leube considers glycogen as a very good nutrient material, but its high price is a hindrance to its general use.

Fat.—Fat was first injected as a vehicle for therapeutical substances. Burlureaux first called attention to the fact that in injections with creosote oil, the nutritive value of the oil plays some part, and he was the first to inject olive oil subcutaneously as a nutrient material. v. Leube then furnished the proof that an insufficiently nourished animal may be brought to a better state of nourishment by the subcutaneous injection of butter, and, further, that the fat deposit produced in this way is, after the injections are stopped, used by the organism to cover the calorific requirement. Starving dogs live longer if they receive oil injections than they do without them.

Also, clinically, oil injections in quantities up to 200 gm. have proved successful. They substitute to a certain degree the supply of fat by the mouth and act as protein economizers. The resorption of the fat is accomplished through the lymph-passages. A few hours after the injection of fat the blood contains fine droplets of fat. It is excreted neither by the mucous membrane of the intestines nor the kidneys, if we except cases of greatly increased injections of fat.

In kidney affections we must be careful in the injection of oil, as it doubtless causes an exacerbation of the albuminuria (Battistini.)

Oil injections deserve a more extensive use in practice, but Leube remarks that at the same time a certain quantity of nitrogen food must be supplied. They are indicated also in diseased conditions with an intolerance for fat with otherwise unimpaired ingestion. Battistini relates a case of severe enteritis in a ten-year-old girl with insufficient splitting of the food. She could not tolerate fat, even in the form of butter, the most easily digestible fat, and after omitting it from her diet she showed a nitrogen deficit and lost weight. She received oil injections of 40 c.c., and, with a deposition of nitrogen, she increased rapidly in weight. For the injection, the best quality of olive oil is used, sterilized by heating for 1 hour over the water-bath, since it decomposes on boiling into irritating products. Twenty to fifty cubic centimeters may be injected daily or 100 c.c. every three to five days. One chooses parts of the skin with flaccid connective tissue and performs the injection slowly. If at the same time an analeptic effect is desired, camphor is added to the oil.

CHAPTER IX

EXAMINATION OF THE STOMACH CONTENTS

(For technique of pumping out the stomach, see Chapter VII.)

Examination of Vomited Matter.—On macroscopical examination of vomited matter we have first to find out if food remnants are present or not. The presence of food residue from meals of the previous days is a sign of severe motor insufficiency of the stomach. If they are little or not at all digested and if between the last meal and the act of vomiting more than three hours have elapsed, it is evidence of a disturbed chemical function of the stomach. Mucus and saliva are constantly present in the vomited matter, but can be recognized with the naked eye only in large quantities. The presence of pus is an exception. It may come from the stomach (abscess, ulcerating carcinoma, phlegmonous gastritis), from the upper air- or food-passages, or from organs whose products of inflammation have perforated into the stomach. Bile is found usually after repeated vomiting or if the act of vomiting has involved great effort. The presence of blood does not permit us to conclude at once that there is hemorrhage from the stomach, since it may originate from the upper air- and food-passages. The longer the vomited matter is exposed to the air, the more the color of the blood changes from red to black and from black to chocolate-brown. If the vomitus is entirely free from acid, these color changes are not observed. The blood undergoes the same alteration if it rests long in the stomach before being vomited. The presence of streaks of blood or even the vomiting of small quantities (1 to 2 teaspoonfuls) is by no means proof of the presence of an ulcer, as it may occur in forced vomiting from every cause.

Examination of the Contents of the Fasting Stomach.—In the morning the stomach normally is empty or shows only a small quantity of contents. If, on a fasting stomach, quantities of more than 50 c.c. are vomited or pumped out, it speaks for a severe disorder of the motility of the stomach, especially for a mechanical obstacle to its emptying. In the material brought up may be found: Mucus (catarrh of the stomach or of the pharynx), pus (cancer), blood (ulcer, gastric varices), pure gastric juice (gastrosucorrhea), ingested food residue (from meals of the previous day), protozoa and especially ascarides, etc.

Test Meals.—The motor and secretory functions can be best estimated if the stomach is pumped out a certain time after a test

meal (test breakfasts of Ewald and Boas, test dinner of Riegel, Seé, Klemperer, and many others), and the material examined as to quantity and composition. The interval between the time of the test meal and its removal depends on the quality of the meal, and in the Ewald-Boas test breakfast (2 cups of tea and 35 gm. bread) is one hour. After a second hour the stomach normally is found to be empty.

Normal Time of Emptying the Stomach in Infants.—The breast-fed nursling empties his stomach one to one and a half hours after nursing (Leo, Epstein); according to v. Puteren, in two and a half hours. The discord between these authors is probably due to a difference in the quantity of the meals in the cases examined. In the bottle-fed infant the emptying of the stomach is certainly retarded, since the stomach often needs three hours to become completely empty.

Disturbances of Gastric Motility.—In adults the stomach should contain no residue of food seven to eight hours after a meat-dinner and two hours after the test breakfast. To test the gastric residue different methods are used (by Jaworski, Mathieu and Rémond, and Strauss). Slight disturbances of the motor function are found in acute and chronic gastritis and in nervous dyspepsia; more severe forms in congenital and acquired atony of the gastric musculature; the most pronounced in the cicatrical stenosis and scirrhous carcinoma of the pylorus. The chemical examination of the stomach contents furnishes further points in regard to the nature of the disease causing the stenosis of the pylorus. In peptic ulcer, hyperchlorhydria is often found; in cancer of the pylorus free hydrochloric acid is often totally absent. In all cases of retention, various quantities of ingested food particles are found. Chemical analysis shows the presence of lactic acid and volatile fatty acids; microscopical examination of the sediment, abundant yeast cells, and bacteria; and in benign processes, sarcinæ, in the cotton-bale form.

Dangers of Retention of Stomach Contents.—These findings are the sign of marked decomposition processes occurring in the stagnant stomach contents. The latter acquires, in this way, properties which act as abnormal irritants to the gastric mucous membrane; in any motor insufficiency of higher degree catarrh of the stomach develops sooner or later, to be recognized by the abundant quantity of mucus, followed by severe disorders of the chemism and motility.

A priori, changes of the secretory and motor functions of the stomach by no means go parallel. Indeed, in decreased gastric secretion one finds occasionally increased motility, perhaps as a compensatory process (Riegel).

Beside these sequelæ, motor insufficiency is, on longer duration, very dangerous for the material equilibrium of the organism. The passage of the chyme into the intestine is hindered, the resorption,

and with this the nourishment proper, is endangered; frequent vomiting and an antipathy for food still further aggravates this condition. The abnormal chemical processes occurring in the stagnant stomach contents remove from the organism a great deal of useful nutrient material, and thereby latent energy; with all this the faculty of resorption of the gastric mucous membrane for soluble substances (sugar, salts, alcohol) is gradually lost. The pathological decomposition of the protein bodies in the gastrointestinal channel leads to autointoxications, which have to be considered as the cause of the different forms of tetany and coma associated with gastrectasis. As results of the chronic autointoxication we have those metabolic and nervous disorders which are associated with gastric and intestinal atony, as chlorosis, neurasthenia, urticaria, erythemas, dermographism, etc. The fermentation processes due to the carbohydrates in the food neutralize probably the deleterious action of the putrefactive bacteria by the energetic production of acid (v. Noorden). This explains the sometimes favorable effect of a vegetable diet in such cases. In febrile patients it is chiefly the appetite and the secretion of gastric juice which suffers, while the motor function remains normal. We succeed, therefore, in keeping febrile patients almost in material equilibrium if we can overcome their dislike for food.

Not only the quantity, but all other properties of the stomach contents, as aspect, color, odor, taste, consistency, layer formation, and abnormal admixtures, are of great importance for the diagnosis.

Changes in the Food Retained.—The quantitative changes of the food residua allow us to estimate the intensity of the carbohydrate and protein digestion in the stomach. These two classes of foods often behave very differently. An increased amount of HCl accelerates proteolysis, but shortens the time of the ptyalin action, and in this way hinders amylolysis. Just the contrary is the case if HCl is decreased in or absent from the stomach.

The consistency of the chyme depends for the most part on its content of mucus. The more mucus is present the more tenacious is the stomach contents, and the harder it is to filter. If an increased amount of mucus is present, gastritis may always be suspected, whether acute or chronic, primary or secondary (*e.g.*, in venous congestion in cardiac diseases).

Separation into Three Layers.—An abundant watery stomach content sometimes shows a separation into three layers, like some sputa. At the bottom of the turbid liquid are the food residua, and there is a middle layer of mucus and a top one of froth, pointing to an abundant formation of gas, due to fermentation. Sometimes in the beaker itself the rising gas bubbles may be observed. These findings are characteristic for gastric dilatation (Ewald).

Bile.—Small amounts of bile are frequently found after repeated violent vomiting, as in the vomitus matutinus due to chronic catarrh, hypersecretion, and gastric crises. If from the onset a greenish liquid is vomited without any special violent action of the abdominal muscles, we must think of an obstacle in the upper part of the small intestine, to a reflex action on the part of the abdominal organs, or to a peritoneal irritation. The constant presence of bile in the vomited matter is of importance for the diagnosis of a stenosis in the descending or inferior (horizontal) part of the duodenum, or in the upper part of the jejunum. In pyloric stenosis bile will never be found in the stomach content, even in obstinate vomiting.

Blood.—Thin streaks of blood are a very common finding in the stomach contents, probably produced by passive congestion, resulting in small hemorrhages (O. Vierordt). In pronounced hematemesis, errors due to red-tinged foods must first be excluded (red wine, raspberry juice, etc.); then confusion with bleeding from another source, as the swallowing of blood. In small, repeated hemorrhages following motor insufficiency, a condition most frequently found in gastric carcinoma, the blood, by the formation of hydrochloric hematin assumes a color similar to that of coffee-grounds, which becomes lighter the longer the blood remains in the stomach. Vomiting of chocolate-colored masses is, therefore, of considerable importance for the diagnosis of cancer of the stomach.

Pus.—Pus can be detected in the stomach contents macroscopically only if brought up so rapidly or abundantly that it evades digestion. This is the more possible as it neutralizes the acidity of the gastric juice through its alkalinity, and in this way inhibits the action of pepsin.

Vomiting of Fecal Matter.—Fecal vomiting will be discussed more in detail in the chapter on ileus.

"Rice-water" Vomiting.—In Asiatic cholera an insipid smelling, alkaline liquid is vomited, which contains small floccules of mucus.

Watery Vomiting.—Also in other conditions the vomiting of watery material is not infrequent, especially in the morning on an empty stomach. We have to deal here with swallowed saliva and gastric mucus (alkaline reaction), with the vomitus matutinus of drinkers and of school children, or with gastric crises which may be the first symptom of tabes incipiens.

Other Pathological Admixtures.—In the gastric contents there may farther be found foreign bodies, tumor particles, shreds of mucous membrane, and intestinal parasites, as whole taeneas, or single proglottides, ascarides, or other more rare parasites.

Odor of Stomach Contents.—The odor of the stomach contents may give a valuable hint for the recognition of certain poisonings or auto-

intoxications (odor of garlic in phosphorus poisoning, of bitter almonds in potassium cyanid or hydrocyanic acid poisoning, odor of alcohol, the odor of ammonia in uremia, of acetone in diabetes). Usually the odor is sour, in accordance with the reaction of the gastric juice; if greater quantities of volatile fatty acids are present, disagreeably rancid. Blood in greater quantities produces the specific, insipid, sweetish smell of which patients with hemoptysis and hematemesis complain spontaneously. The odor of H_2S following immediately the act of vomiting or the removal of the stomach contents points to a long stagnation of the contents in the stomach. A putrid smell is observed in exulcerating tumors of the stomach, a feculant one in ileus and in fistulæ between the stomach and intestines.

Chemical Analysis of Gastric Juice.—The chemical analysis is best made in the following order:

1. Reaction.
2. Free HCl.
3. Lactic acid.
4. Quantitative determination of the free and combined HCl.
5. Quantitative determination of lactic acid of the volatile fatty acids.
6. Examination of gastric ferments.

Reaction.—The reaction of the stomach contents is tested by litmus tincture or congo-red.

Hydrochloric Acid.—To test free hydrochloric acid, various reagents may be used (roseanilin, azo coloring matter, and vegetable coloring matters). Günzburg's reagent seems to give the best results. It consists of phloroglucin 2 gm., vanillin 1 gm., absol. alcohol 30. Three drops of stomach contents are placed with an equal amount of the reagent in an evaporating dish, and with constant moving, slowly heated over a small flame. If free HCl is present, a beautiful carmine red appears for a moment before the mixture boils. Dimethylamido-azobenzol (in 1/2 per cent. alcohol solution) may be used in testing for free HCl, the color changing from red to yellow according to the presence of larger or smaller amounts of free HCl. (Töpfer's test).

Lactic Acid.—Lactic acid is tested by Uffelmann's or Kelling's test. The first method is used in the following way: We pour into a beaker a certain amount of a 4 per cent. carbolic acid solution and add enough drops of a 5 per cent. aqueous solution of ferric chlorid to cause the liquid to take on an inky blue color. Equal parts of gastric juice and water are placed in two test-tubes, and to each of them a few drops of the reagent are added. The water becomes a deeper blue the more reagent is added; the stomach contents only if it contains no lactic acid. Otherwise a discoloration of lemon-yellow color appears. Since a higher amount of HCl obscures this

reaction, and, on the other hand, a few food materials, as meat, eggs, milk, and some cakes, give a similar color reaction, Uffelmann's test is absolutely reliable only if made with the ether extract of the stomach contents, in which lactic acid exclusively is contained, and if a test breakfast has been given, omitting the foods just named; for instance, a soup of oatmeal with some salt (Boas).

Quantitative Determination.—(*a*) *Of Hydrochloric Acid.*—For the quantitative determination of HCl there exists a number of more or less reliable methods, as those of Cahn and Mering, Hehner and Seemann, Sjoquist and Leo, Hajem and Winter, Luttke, Mierzynski, Moracewski, Cordier. All these methods are unsuitable for routine work, as they demand much time, extensive apparatus, and a thorough familiarity with chemical methods. A simple and easy method is that of Töpfer, which is at the same time free from objections. In three small beakers we place 10 c.c. of filtered stomach contents. With the first beaker we determine the total acidity by titration with a decinormal solution of sodium hydroxid, using phenolphthalein as indicator; we add alkali until the test fluid takes a persistent red color. In the second beaker we titrate with the addition of a few drops of dimethylamidoazobenzol until a persistent yellow color appears. The number of cubic centimeters of sodium hydroxid used multiplied by the factor 0.00365 gives in grams the amount of free HCl, which was present in the sample of stomach contents. In titrating the third sample we use as indicator a watery solution of sodium alizarin sulphonate until its coffee-brown color assumes a persistent violet hue. Since with the latter, not the combined HCl, but all acids with the exception of the HCl have been neutralized, the result obtained has to be subtracted from the value found for total acidity. The difference then gives the number of cubic centimeters of alkali which are necessary to neutralize the combined HCl. This result, multiplied by 0.00365, gives the combined HCl in grams contained in 10 c.c. of stomach contents. For practical use the apparatus of Jolles (calorimetric method with methyl violet) or the acidimeter of Lohnstein (founded on Töpfer's method) are satisfactory.

(*b*) *Of the Other Acids.*—For the quantitative estimation of lactic acid, Uffelmann's test is made with the ether extract of the stomach contents, the gradually diluted gastric juice being compared with the color of lactic-acid solutions of known concentrations.

The volatile fatty acids may be estimated by determination of the total acidity of a sample of gastric juice before and after boiling.

Examination of Gastric Ferments.—Ferments are tested by digestion experiments in the thermostat at body temperature. Syntonin (acid albumin) may be recognized on neutralization of the

stomach contents by the formation of a precipitate. Propeptones and peptones give the biuret reaction.

Disturbances of the Gastric Secretion.—The normal HCl secretion varies between 40 and 100 according to Kaufmann (*i.e.*, the number of cubic centimeters of a decinormal sodium hydrate solution to 100 c.c. gastric juice). Still higher acid values may exist without subjective discomfort. However, with other simultaneous factors they play a great rôle in the pathogenesis of gastric hypersecretion. A diminished amount of free HCl (*i.e.*, below 30) is found in the various forms of anorexia, in gastritis, in cancer of the stomach, in sclerotic gastritis of old persons, and in the achylia gastrica. The chemical function of the stomach in peptic ulcer may be entirely intact, or there may be hyperchlorhydria, which may even persist if a carcinoma develops on the floor of an ulcer.

(*a*) *In Adults.*—Achlorhydria always arouses the suspicion of the presence of gastric carcinoma, in which it is found in 77 per cent. of all cases. HCl may also be completely absent in achylia and in chronic gastritis existing for several years. In old age the gastric chemism may be normal or, from arteriosclerotic changes in the gastric mucous membrane or from the persistent mechanical irritation due to failing teeth, achlorhydria may arise. The activity of the HCl secretion is of importance for the nourishment also in secondary disorders of digestion, as phthisis, cardiac diseases, renal affections, anemia, etc., and ought, therefore, to be controlled for the purpose of giving suitable dietary treatment.

(*b*) *In Infants.*—In infancy the amount of acid and pepsin is usually much lower than in adults. Between healthy and sick artificially fed children no great difference exists in this regard. Heubner often failed to find free HCl even in healthy children. Pepsin is usually to be detected; rennet or its zymogen, constantly. In infants in the first weeks of life, v. Puteren found HCl constantly, lactic acid rarely, volatile fatty acids never. Leo, however, ascribes the hyperacidity, which he often found, to the increased amount of volatile fatty acids. Hyperchlorhydria is very seldom observed (for instance in spastic pyloric stenosis, Knöpfelmacher).

In congenital pyloric stenosis the HCl secretion varies in amount. The cause of this lies chiefly in the fact that the physiological food, for infants, milk, is unfit for the test-meal. If the chief constituent of a test-meal is chemically fit for the purpose, as, for instance, a decoction of barley flour, the stomach of the infant reacts in a way which permits no conclusions as to the digestion of milk (Hamburger and Sperk).

Milk, on account of its protein and salt ingredients, binds a considerable amount of HCl. The fixation power of woman's milk

is only half as high as that of cow's milk, according to Escherich. It has been demonstrated, farther, that curdled cow's milk is far inferior in binding power to the uncurdled milk (Julius Schütz). Since the curdling by rennet does not always occur in the same complete and prompt way in the infant's stomach, there thereby arises a factor which is outside our calculation; the amount of free acid found is therefore, not of the same significance in the pathology of infancy as in that of adults.

We will, therefore, only in considerable deviations from the normal draw conclusions from the examination of the free HCl. The rapid and marked appearance of the reaction is striking in children nourished with cow's milk, its entire absence in those fed naturally. The examination for ferments has also proved of no semiotic value, and since the appearance of lactic acid and volatile fatty acids, even under physiological conditions, is subject to the greatest variations, there remains only one method of examination for the functional diagnosis of the infantile stomach. We may conclude that the motility is disturbed if one and one-half to two hours after the last breast feeding, or three hours after the last bottle feeding, food residua are still found in the stomach (Epstein, Szydlowski). The greatest quantity of residual food is found in stenosis of the pylorus if the stomach has not been emptied by vomiting before the stomach-tube was passed. In this disease, food rests, considerably thickened, in amounts of 20 to 50 gm. may be found four to five and even ten hours after ingestion (Pfaundler).

An anomaly of secretion may, too, be found in pyloric stenosis; namely, an increase of the total acidity due to fatty-acid fermentation and hyperchlorhydria.

The presence of mucus is of value for the diagnosis of catarrhal affections of the gastric mucous membrane. The microscopic and cultural examination of the stomach contents have given neither diagnostic nor therapeutic data.

Significance of Lactic Acid.—Lactic acid is found in small amounts and only rarely in benign pyloric stenosis and other forms of motor insufficiency (hour-glass stomach); but in the plurality of cases of cancer of the stomach. In about 85 per cent. of all stomach affections with lactic acid fermentation, carcinoma may be suspected; the rest is divided among benign pyloric stenosis, severe gastritis, and atrophy of the gastric glands. As already mentioned, certain foods may be a source of error. Constant absence of HCl and a considerable amount of lactic acid, together with stasis, even in the absence of a palpable tumor, justify the diagnosis of cancer.

Fatty Acids.—Butyric acid, acetic acid and succinic acid, etc., may be formed in the stomach by fermentation processes, butyric

acid without ingestion of fat. Acetic acid is more rarely the product of a far-reaching carbohydrate decomposition than of alcohol fermentation and points to alcoholism (Boas).

Digestive Ferments.—The absence of digestive ferments in the gastric juice is a still more severe symptom than the absence of free HCl, and points to degeneration of the peptic glands (chronic catarrh) with atrophic changes, carcinoma, or amyloid degeneration.

Trypsin.—If bile is found in the stomach contents, pancreatic juice is usually present also. If on the vomiting of bile, trypsin is constantly absent, we may conclude that there is an obstacle to the pancreatic flow. Of importance is the chemical, microscopic, and spectroscopic examination of blood, since the macroscopic examination is too unreliable.

Microscopical Examination.—The microscopical examination of the sediment of the unfiltered stomach contents for food remains and abnormal mixtures is a necessary supplement to the other methods of examination.

The presence of muscle fibers, starch granules in different phases of digestion, fat globules, cellulose, connective tissue, etc., may be demonstrated. That the transverse striation of the muscle fibers has disappeared is no proof of a sufficiently abundant or active secretion. We have, of course, always to bear in mind the phase of digestion in which the contents left the stomach. The phase of starch digestion may be determined quite well, especially by the use of Lugol's solution. Sometimes pus corpuscles, epithelial cells, even gland ducts, the latter especially on the empty stomach, may be observed. The epithelium (cylindrical, pavement, alveolar) permits a conclusion as to the origin of a lump of mucus, whether from the stomach or esophagus, pharynx or upper air passages. Ewald and many others have observed cancer-cell nests in the sediment, which render a diagnosis of cancer certain. Erythrocytes can be found in a recognizable state only if the blood has been vomited immediately after its effusion, if it has been examined at once, and if free HCl was present only in small amounts. As an amount of 2 *pro mille* HCl in the stomach is necessary to develop antiseptic action, microorganisms will be a constant finding in the stomach contents of the normal healthy individual. According to Minkowski, saccharomyces and hyphomycetes are usually found if free HCl is present, but no schizomycetes, the latter preferring an absence of acid.

Yeasts.—Yeast cells are found in small amounts in the normal stomach contents; on stagnation they develop abundantly, and then are no longer found as single individuals but in groups in all stages of sporulation.

Sarcinæ.—Great importance has been ascribed in earlier times

to the occurrence of sarcinæ whose characteristic cotton-bale form was described by Soodsir in 1842. We know to-day that they occur in many stomach diseases, that they are chiefly found in benign disorders of the motor function, and that they speak against the diagnosis of carcinoma of the stomach (Oppler).

Lactic Acid Bacilli.—For this diagnosis the presence of lactic acid bacilli is valuable; these may be recognized, even in the native preparation, by their size, chain-like arrangement, and absence of motility (Oppler-Boas, Schlesinger-Kaufmann). Especially in pyloric stenosis, the absence of these bacilli renders a carcinoma of the pylorus improbable. If a benign pyloric stenosis undergoes malignant degeneration one may directly observe how the sarcinæ are gradually replaced by the lactic acid bacilli (Zweig).

The Gastric Contents in the Commonest Stomach Diseases.—*Catarrh of the Stomach.*—Catarrh of the stomach is characterized by abundant masses of mucus and badly digested food residua. Though some mucus is secreted even by the healthy gastric mucous membrane, it is again mostly digested if the functions of the stomach are normal. Other important signs of catarrh are a decreased amount of HCl and of enzymes. There exist forms of gastritis which are associated with hyperchlorhydria, but most cases of "sour catarrh" have probably to be considered as secretory neuroses. The motility and resorption are markedly injured in subacute and chronic gastritis, which is plainly expressed by the abundant residua in the stomach.

Atrophy of the Gastric Glands.—In the final stage of a severe gastritis, as after cauterization with poisons, in carcinoma of the stomach and of other organs, as, for instance, the mamma, in chronic saturnism or long existing absence of teeth, in old age, and in most cases of pernicious anemia a complete achylia ("anadenie" of Ewald) is found; free HCl and the ferments are absent, but lactic acid is present in varying amounts. Mucus is absent only when the mucous membrane has entirely perished, otherwise, owing to mucoid degeneration of the epithelium the production of a tenacious mucus may persist for a long period. This atrophy, which attacks the intestines also, the "atrophia gastrointestinalis progressiva" of Jurgens, has been considered by some authors as the characteristic anatomical change of progressive pernicious anemia; but it is by no means a constant finding in this disease, and not pathognomonic of it.

Cancer of the Stomach.—In carcinoma of the stomach, free HCl is not found in the greatest number of cases. The ferments, too, are absent. Lactic acid is almost constantly present. If the neoplasm is localized in the pylorus, marked signs of disturbed motility appear soon, gradually increasing to a motor insufficiency of the second degree, so that the stomach is not emptied between the meals, nor

from the evening until the morning. Coffee-ground or chocolate-colored masses in the vomitus, particles of tumor, lactic acid bacilli, and the absence of sarcinæ are important findings.

Ulcer of the Stomach.—In ulcer of the stomach the demonstration of HCl is of great diagnostic value, though there are numerous cases in which this sign is absent. Of great significance is the appearance of hematemesis or blood in the stools on an entirely meat-free diet, if all other causes of hemorrhage can be excluded, as hemophilia, gastric varices, uncompensated heart lesions, stasis in the portal region, vicarious gastric hemorrhage, hemorrhoids.

Dilatation of the Stomach.—Dilatation of the stomach is a secondary condition in which the abnormal amount of the vomited matter or of the residua in the stomach is striking. Food particles which have been eaten several days before may be found. The chemism shows various changes according to the primary disease, from marked hyperchlorhydria to the absence of any trace of HCl. In subacidity, lactic acid is to be found; fermentation of the carbohydrates and protein putrefaction may be found, even with a sufficient amount of HCl.

Secretory Neuroses.—The behavior of HCl and the composition of the gastric contents in the secretory neuroses are dependent on the nature of the neurosis in question. We distinguish:

1. Nervous hypersecretion through irritation by food (the alimentary hypersecretion of Zweig).

2. Gastrosuccorrhea, the intermittent and continual hypersecretion, Reichmann's disease.

3. Nervous hypochlorhydria or even achylia. If a continual hypersecretion exists for a longer period, a dilatation of the stomach may develop as a complication, due to the disturbed starch digestion, and the hindered motility, from reflex spasm of the pylorus (Bouveret).

Therapeutical Views.—*Acute Catarrh.*—In acute gastritis, complete abstinence from food, the removal of injurious ingesta by washing out the stomach, intestinal lavage or cathartics, are the most efficacious methods for achieving prompt recovery. In children who suffer from a severe ptomain intoxication, lavage of the stomach may be the means of saving life. If the poisonous matter has been removed, the subacidity may be compensated by the administration of dilute HCl (10 drops to half a glass of water), the appetite and secretion may be stimulated by amaras, and fermentation combated by antifermentative agents (menthol, creosote, resorcin, ichthyol).

Chronic Catarrh.—In the chronic catarrh we will aim to combat the enormous production of mucus, the diminished secretion of the gastric juice, the disturbed motility, and the fermentative processes. A uniform diet for all cases does not exist. If the motility is good and the intestines are not affected, fats, especially in the form of

butter and cream, are tolerated; otherwise, especially if the duodenum or the liver is involved, they must be avoided. Proteins are badly digested in subacidity; in this case light puddings, as of oatmeal, are suitable, meat only in scraped form. Mineral waters are often of beneficial effect, having chiefly the function of dissolving the mucus by their alkalinity, and in this way removing it. Even more efficacious is the stomach lavage with alkaline liquids, solutions of bicarbonate of soda, Karlsbad waters, or, according to Penzoldt, a mixture of 4 tablespoonfuls of lime-water (aqua calcis) to 1 liter of water. The administration of HCl in subacidity, and of pepsin (1 gm.) papayotin, papain (0.25 to 0.5 gm.), pancreatin (with bicarbonate of soda, āā 0.5 gm. *pro. dos.*) in the absence of ferments, are to be recommended.

The discomfort in hyperchlorhydria or in excess of acid due to fermentation is combated by large, repeated doses of calcined magnesia, or of carbonate of magnesia with sodium bicarbonate (āā). In motor insufficiency, lavage of the stomach, frequent small meals, decrease of liquids, thirst and cleansing enemas, electric treatment of the abdominal walls, and massage and gymnastics constitute our therapeutic arsenal.

The use of mineral waters must be modified on account of the atony; in a Karlsbad treatment, for instance, small quantities, about 50 gm. of the prescribed spring, must be taken three to five times a day, one-half to one hour before meals. Fermentation processes are combated by improving the motor function, by lavage of the stomach (eventually with the addition of resorcin 5 : 1000), and by the administration of antifermentatives proper; creosote and creosatol 0.05 *pro dosi*, ichthyol 0.1 gm., menthol 0.05 gm., resorcin, β-naphthol, benzonaphthol, etc. A diet rich in carbohydrates will be chosen in subacidity, but foods rich in drossy matter, or fermenting easily, have to be avoided. Proteins in appropriate form, as light meats, sour milk, and soft eggs are permitted in hypochlorhydria, for the tryptic digestion in the intestines may compensate for the deficient gastric proteolysis.

Secretory Neuroses.—In hyperchlorhydria, the period of starch digestion in the stomach is too short, and in hypersecretion the amylolysis is, from the beginning, severely injured. We therefore give starch in a predigested form. Beside large doses of alkalies, ptyalin (0.5 to 1 gm. *pro. dosi*) is given with good results. A bland diet is desirable, in order not to stimulate further the hypersecretion. Meat and fat are usually very well tolerated. Starches must be given in purée form, so that they will soon leave the stomach. The frequent taking of milk to fix the acid, and of good fat (butter, cream) to decrease the secretion, deserve recommendation. Walko prescribes

for the hyperchlorhydria of gastric ulcer, olive oil up to 50 c.c. three times a day. Rummo, on the other hand, is opposed to the administration of fat, since it decreases the pancreatic activity and the secretion of bile. In motor insufficiency fat has to be avoided. Good results are often obtained by drinking alkaline mineral waters (as Karlsbad, Vichy), combined with small doses of morphin or extract of belladonna. Lately, Eumydrin has been advocated. (Sod. bicarb. 1 gm., eumydrin 0.002. DS. One powder three times a day. Or: Eumydrin 0.002, butyr-cacao q. s. ut f. supposit. DS. One suppository two to three times a day.) Reichmann and Rosenheim recommend rinsing out the stomach with a 1 *pro mille* solution of silver nitrate, which may be done by means of A. Pick's instillation catheter.

Ulcer of the Stomach.—Two factors have to be distinguished in the treatment of gastric ulcer: the treatment of the ulcerative process proper and the treatment of the hemorrhage and its sequelæ. The treatment of the ulcer cannot be taken up in detail here; the therapy of hematemesis is given in the chapter on Internal Hemorrhage. Here only the dietetic measures may be briefly mentioned. After a gastric hemorrhage a complete rest of the stomach is indicated; in the first week nutrient enemas are to be given, but without the addition of alcohol, since Spiro observed a reflex increase of the secretion after its use. In the second week milk furnishes the chief part of the food. For the fixation of the acid proteins are given as well as alkalies, above all milk, eventually with the addition of sanatogen, plasmon, nutrose, bismutose, etc. Later on the yellow of egg is added. Of alkalies, beside Karlsbad water, lime-water (1 tablespoonful to 1/4 liter milk), and calcined magnesia have chiefly to be recommended as they produce no gas in neutralizing the acid. The following mixture is often given:

Sodium bicarb.,		
Magnes, ust.,	āā	10.00
Extra. belladonn.,		0.25

DS. One knife-pointful three times a day.

The use of bismuth (subnitrate, carbonate, or salicylate) in large doses (1 to 2 gm. *pro dosi*) seems to have a very favorable effect in chronic ulcer; on longer use it is best combined with alkalies.

Rp.	Bismuth salicyl.,		2.0
	Magnes. ust.,		
	Natr. hydrocarbon.,	āā	15.0

MDS. One knife-pointful immediately after meals and one two hours later.

Gerhardt, Liebermeister, Boas, and others recommend the old treatment of Trousseau, with the chlorin-binding and astringent

silver nitrate (0.2 to 0.4 : 120 Aqu., 1 tablespoonful daily—Boas). The stomach douche with a 1 pro mille solution of silver nitrate is not to be recommended in gastric ulcer.

Motor Insufficiency.—The motor insufficiency of the stomach must be treated mechanically, independent of the primary disease, as long as the patient does not permit surgical intervention. The residua in the stomach, which are in a state of decomposition, must be removed by the stomach-pump before the chief meals, and this procedure followed by the lavage with antiseptic solutions. The diet has to harmonize with the changes of the gastric chemism. Small repeated meals and a moderate restriction of liquids, with daily enemas, are in all cases indicated. The physical treatment (massage, electrization, gymnastics, hydrotherapy, cultivation of sports) is of undoubted value in gastric atony; in dilatation of the stomach, if motor insufficiency of the second degree exists, the surgical treatment exclusively is indicated, gastroenterostomy or pyloroplasty.

As indications for operation the following may be given (Zweig):

1. Increase of food residua found in the morning in spite of regular stomach lavage.
2. Decrease of the daily amount of urine below 500 c.c.
3. Constant loss of weight.

Patients, as traveling agents, who cannot undergo dietetic and mechanical treatment, ought to be operated even sooner.

The treatment of the digestive disorders of infancy are taken up in the chapter on Examination of the Stools.

CHAPTER X

DISEASES OF THE INTESTINES

A. DIARRHEA

By diarrhea we understand the passage of liquid stools. As a rule, they are at the same time increased in number, but this increase, of itself alone, cannot be designated as diarrhea, for it is found together with a firm consistency of the stools in cases where the intestine, from insufficiency of its musculature, is unable to remove its contents at one passage.

Diarrhea is produced:

1. By increased peristalsis, whereby the intestinal contents are removed in a shorter time before the liquid constituents have been absorbed.

2. By decreased resorption on the part of the intestines.

3. By the excretion of liquid, and especially of mucus, by the intestinal mucous membrane into the intestinal lumen.

Alimentary Diarrhea.—The cause of diarrhea may lie in the composition and quality of the food and of the intestinal contents, or in certain abnormal conditions of the organism. By the ingestion of large quantities of liquid food, by drinking great amounts of waters containing CO_2, by the abundant use of plant acids, fruit, or vegetables, diarrhea may arise. Here belongs the diarrhea produced by certain cathartics. Through a high content of fat caused by a too abundant fat supply or insufficient fat resorption in the intestines, the stools may assume a soft consistency.

Appropriate dietetic measures will, in all these conditions, remove the morbid symptom. Liquid foods, thick soup, tea, cocoa, especially acorn cocoa, acorn coffee, and certain wines will be of good service in such cases.

Reflex Diarrhea.—Through thermic irritation, as the sudden effect of cold, refrigeration of the abdominal walls, by getting wet through, or by cold douches on the abdomen, an increase of peristalsis, and thereby transient diarrhea may result. In the same way may act ice-cold drinks. In such cases the diarrhea develops only from the increased peristalsis and the resulting poor digestion and water resorption.

Diarrhea from Intestinal Decomposition.—Fermentation and decomposition processes in the intestinal tract may, too, lead to diarrhea.

In these cases styptics should not be prescribed, since they cause a longer presence of the decomposed masses in the intestine. The treatment is best begun with intestinal lavage or by administering a mild cathartic, as calomel or castor oil, after which one gives menthol, resorcin, bismuth salicylate, the latter in doses of 0.3 to 0.5 gm. three times daily, alone or combined with 0.05 gm. menthol. In obstinate cases, small doses of creosote, 0.05 gm. one to three times a day, render good service.

Gastrogenous Diarrhea.—If the diarrhea continues it will be advisable to make an examination of the gastric chemism. In an existing hypochlorhydria, which favors abdominal decomposition processes by the decreased disinfecting action of the HCl of the gastric juice, and where food passes into the intestine insufficiently digested, the administration of dilute HCl may bring to a standstill a diarrhea which until this time had not responded to any kind of treatment.

Jaundice is usually associated with constipation, but diarrhea may sometimes be observed. It is best combated by appropriate dietetic measures and by enemas. In this connection it is to be remembered that with a hindered flow of bile into the intestine the fat digestion is considerably injured and that very violent diarrhea may be produced by the ingestion of fat. Only in the form of milk is fat permitted in jaundice.

Intestinal Catarrh.—The localization and severity of intestinal catarrhs are to be determined chiefly by the examination of the feces, but also from other concomitant symptoms.

Undigested muscle fibers, starch granules, and fat in the form of neutral fat, fatty acids, and soaps, and mucus in small clumps, suspended in the usual watery brownish stools, are findings which speak for catarrh of the small intestine. In the catarrh affecting the large intestine only very few undigested food residua are found in the stool, but mucus exists in large coherent masses, partly membranous, partly jelly-like.

It must be emphatically stated that diarrhea is no essential symptom of an acute intestinal catarrh. Chyme passes through the small intestine very rapidly, even under normal conditions; the slow forward movement and considerable water resorption is first found in the large intestine. Only if involved in its greater part or if its peristalsis has been much increased by the jejunal catarrh will diarrhea appear.

The importance of the examination of the feces for the localization and diagnosis of intestinal catarrh was recognized by Nothnagel many years ago, and on his fundamental investigations rest our chief knowledge of this condition. Whereas in chronic catarrh of the small intestines constipation exists frequently, even if the upper

part of the cecum is involved, in the chronic catarrh of the large intestine constipation is frequently interrupted by attacks of diarrhea.

In violent diarrhea the possibility of arsenic or sublimate poisoning must be suspected; the first intoxication has a great similarity with the picture of Asiatic cholera, the latter with that of dysentery. Venous stasis of the intestinal mucosa due to general or portal congestion may lead to an intestinal catarrh (as in heart failure, emphysema of the lungs and liver cirrhosis); further, infectious processes of the intestinal mucous membrane which sometimes cause ulceration.

Dysentery, occurring in epidemic form, is a much feared scourge in the tropics, but also in our regions a severe and not infrequent disease. Since we recognize Flexner's and Shiga-Kruse's bacilli as the infecting agents in the bacterial dysentery (aside from the rarer amebic form of the disease), it has been found that many follicular forms of enteritis, especially in children, are often nothing else than true dysentery. The bacteriological diagnosis is here not only of theoretical interest, but of great practical importance for the treatment, as specific sera have been used with very encouraging results (Vaillard and Dopter, Krauss and Doerr).

Ulcer of the Intestines.—We distinguish catarrhal, tubercular, syphilitic, and typhoid ulcers, and those caused by anthrax and actinomycosis. After extensive cutaneous burns, ulcers develop in the intestine, but they are, like peptic ulcers, chiefly located in the duodenum and cause usually no diarrhea (v. Leube).

In the course of a septicemia, emboli, with necrosis and subsequent ulceration, may develop; intestinal amyloidosis may, too, be a cause of ulceration from an insufficient blood supply resulting from the diseased blood-vessels (v. Leube).

Rarer causes of intestinal ulcer are traumas by foreign bodies or hardened, conglomerated scybala; other causes are leukemic infiltration of the intestine and intestinal hemorrhages in the course of the hemorrhagic diathesis. Some poisons are excreted by the intestines, as the mercury salts, producing changes which in some cases are pathologically very similar to dysentery.

In uremia irritation of the intestine arises, sometimes ulcers even may be produced; the urea excreted into the intestines is changed into ammonium carbonate, a body which irritates the intestinal mucosa.

Almost all ulcerative processes may occasionally proceed without symptoms, being found accidentally at postmortem. In other cases they produce violent pain and almost intractable diarrhea, with the passage of mucus, pus, and blood.

Treatment.—Only rarely are we in a position to influence directly the sanation of the ulcerative processes. Thus in syphilitic ulcers, by general specific treatment, and on localization of the ulcer in the rectum by appropriate local therapy. In general we shall have to be satisfied by producing favorable conditions for the healing. The intestine must be cleansed by injections of water or oil, but the greatest caution must be employed in this procedure on account of the danger of perforation: on the slightest pain the enterolysis must be interrupted. The quantity of water (not more than 1/2 liter), and the pressure exerted must be controlled carefully.

If the ulcers are situated too high to be reached in this way, castor oil may be cautiously tried. Calomel is not advisable, as the sublimate set free may cause necrosis of the mucosa. Drastics are entirely contraindicated. Castor oil in emulsion may be given unhesitatingly if the danger of intestinal hemorrhage or perforation is not imminent.

All ulcerative processes demand absolute rest in bed and a nonirritating diet. For duodenal ulcers the same diet is indicated as in gastric ulcers. Ulcers of the other parts of the intestines render necessary the diet of acute or chronic enteritis, according to their course (Pentzoldt).

Of medical remedies the astringents and certain antifermentatives may be given, above all bismuth preparations, as bismuth subnitrate or salicylate, dermatol, bismutose (a bismuth albuminous compound). Of the antifermentatives we prefer menthol. Co-existent pain and violent peristalsis must be combated with opium.

Tubercular Ulcers of the Intestine.—In tubercular ulcers of the intestine the importance of prophylaxis is to be emphasized. Each subject of phthisis is in danger of acquiring an intestinal tuberculosis if he swallows his sputum. This is especially dangerous on an empty stomach, since the bactericidal action of the gastric juice furnishes no protection at this time. If the sputum has been swallowed unawares, Pentzoldt advises eating a piece of bread after it, to stimulate the HCl secretion.

The diet in tubercular ulcer of the intestine will have to maintain the golden mean between the indication for sparing the intestine and for overfeeding. At any rate, it is advisable to prescribe a diet of high nutritive value, but nonirritating, if only the condition of the intestine will permit. Stagnation must be met by careful administration of castor oil, diarrhea by tannigen, tannalbin, tannoform, orphol, orthoform, etc. It may be mentioned that some tubercular patients suffer from severe diarrhea without ulcers being found postmortem.

Paradoxical Diarrhea.—A unique form of diarrhea may still be mentioned, as it seems paradoxical in the face of the condition in

which it occurs. The stool usually becomes thick from the loss of water on sweating. If, now, there is a tendency to the production of toxins in the intestine, the toxin becomes more concentrated in the thickened stool, and in this way leads to irritation and increased peristalsis. An abundant ingestion of liquids is indicated in this rare form of diarrhea.

Diarrhea from Intestinal Parasites.—Intestinal parasites, as teniæ, ascarides, trichinæ, may give rise to another form of diarrhea whose treatment must be directed to the removal of the parasites. In regard to the amebæ and monadina found in the liquid stools, Nothnagel ventured the opinion, that the liquid consistency of the stool furnishes a favorable medium for their development, and that these protozoa do not cause the diarrhea, but, vice versa, their existence is rendered possible by it.

Diarrhea from Inanition.—Trousseau first called attention to the form of diarrhea which, though not frequently found, is in individual cases of no less therapeutical interest. If a patient has declined very much in the course of a gastrointestinal catarrh, diarrhea may persist from the underfeeding. In this way a *circulus vitiosus* arises, which can only be interrupted by nourishing the patient more abundantly, though with a bland diet. With an improved condition of the strength the great irritability of the intestinal tract soon ceases. We have here perhaps an analogy with the rare diarrhea of those children who do not find sufficient nourishment at the breast.

Nervous Diarrhea.—The influence of the nervous system, especially of the mental processes, on peristalsis, is proved by the known fact that anxiety may produce diarrhea. In neurasthenic or hysterical individuals who have suffered from an anatomical disease of the intestines the exaggerated fear of the expected defecation may produce diarrhea. This may be distinguished from the catarrhal form in that it is quite independent of the quality of the food taken in and that only minimal amounts of mucus are found in the stools. The quality of the stools sometimes changes during the course of a day. Psychical influences play an important rôle in the origin of nervous diarrhea. Nothnagel related a case of nervous diarrhea which appeared constantly whenever the patient started to leave the house. A. Pick reports a similar case in his treatise on stomach and intestinal diseases.

"In a patient in whom a severe intestinal catarrh had frequently caused involuntary evacuations, a state of peculiar irritability of the intestine was developed, of the kind that as soon as the patient tried to walk down streets with whose locality he was not very familiar or if he was spoken to by acquaintances on the street, he was seized

by tenesmus and even by diarrhea, caused by the anxiety lest he could not at once yield to his bodily necessity.

"The patient had to give up his profession on this account and led a very unenviable existence, as he was unable to take a walk or make excursions or frequent society."

The treatment of this condition consisted in the production of constipation by energetic styptics. On longer walks the patient was still vexed by tenesmus, but could not defecate. This gave him a certain assurance, at first for a few hours and later for a longer time. He regained self-confidence which outlasted the styptic treatment. To get rid of the slight persistent chronic catarrhal symptoms, the patient took the Karlsbad cure and regained full health. Nothnagel has obtained complete recovery in some cases of tormenting suffering lasting for years by medication with arsenic.

In the class of nervous diarrheas belong, too, the profuse watery, but mostly mucus-free diarrhea of morbus Basedow, of hemicrania, toward the end of the attack, and of sexual neurasthenia of both sexes.

Bacteriotoxic Diarrhea.—Sometimes diarrhea similar to uremic diarrhea is produced by poisons circulating in the blood. Beside the specific and tubercular diarrheas, previously mentioned, where anatomical changes cannot be found, the diarrhea occurring in the course of malaria is to be mentioned, which shows its relation to this disease by its prompt reaction to quinin. In measles and scarlet fever severe toxic cases are often associated with profuse diarrhea, the feces being characterized by a putrid odor.

General Treatment of Diarrhea

Acute Diarrhea.—Any organ, if diseased, needs, in order to regain its normal function, rest and sparing. But just in the diseases of the digestive organs this requirement cannot always be met with to the desired extent for a sufficiently long period of time, as nourishment and the general condition cannot be left out of consideration. We are compelled, therefore, according to the strength of the patient and the nature of the disease, to make a compromise between the prohibition and the supply of food.

If a robust person is taken with a severe acute diarrhea we may safely make the sparing of the intestinal canal our first consideration; we give only tea for twenty-four to forty-eight hours, sweetened with saccharin to avoid the fermentable sugar, bouillon, red wine, and albumen water, later on meal or barley soup and tea with milk are permitted; in these last foods there is again possibility of fermenta-

tion processes. One does well, therefore, to give some dilute HCl in these cases (5 drops acid hydrochlor. dilut. in 1/2 glass water).

Red wine and cognac may be given in small quantities if the strength of the patient is failing. Champagne is better avoided on account of its carbonic acid and sugar content. In regions where the drinking water is bad carbonic acid waters may be given, but it is advisable to allow the CO_2 to escape before drinking. If improvement continues on the prescribed diet, one may after a few days try sweetbreads, finely hashed beefsteak or veal, and puddings of rice, grits, and sago, which are not rich in butter. Later on, boiled-flour foods are permitted, for the preparation of which dextrinized flour may be advantageously used. A further enlargement of the menu is furnished by purées of carrots and potatoes, and young vegetables, as aspagarus-heads and cauliflower. Fresh butter is permitted in small quantities. Two or three weeks after the last symptoms a mixed diet may again be permitted.

Chronic Diarrhea.—Some authors, as Rosenfeld, advocate severe dietetic measures also in the treatment of chronic diarrhea. With rest in bed the calorific requirement of the patient is covered as well as possible with oat cocoa, zwieback, and thick soups, until formed stools appear; the diet may then be enlarged very cautiously, but on any slight relapse one returns at once to the original nonirritating diet.

Others avoid all irritating substances which give residua and try to nourish the patient with milk, acorn cocoa, and decoctions of children's foods. If milk is not well tolerated, kefir, three days old, may be prescribed; this may be made, if some care is taken, at the home of the patient. It is advisable to take the kefir in tablespoonfuls if diarrhea is present.

Winternitz praises the constipating action of a huckleberry decoction; it is prepared in the following way: 1/4 kg. of dried huckleberries are boiled with 1 1/2 liters of water for two hours, until the decoction has the volume of about 3/4 of a liter; this is then filtered, the berries are pressed out and then added to the filtered fluid; the whole is placed in the cold, and a cup of it is given mornings and evenings.

Trousseau recommended raw scraped meat or the inside of a beefsteak broiled for only a few minutes over a very hot fire. A bland antidiarrheic diet is sometimes indicated also in the nervous forms of diarrhea, especially in those cases where a direct connection exists between the ingestion of food and the diarrhea.

In other cases, in which the diarrhea depends clearly on psychical influences, the indication will be to improve the self-confidence of the nervous patient through a liberal diet which they had thought could not agree with them.

In the following we give a menu for chronic diarrhea, according to Ewald·

I. *Breakfast*

250 c.c. acorn cocoa, 1 soft egg, or
300 c.c. milk with cream.
50 gm. toast.

II. *Breakfast*

50 gm. finely scraped raw meat with salt and anchovies, or
50 gm. meat jelly.
100 c.c. milk.

Luncheon

180 c.c. thick soup with about 10 gm. nutrose, eucasin, sanatogen, peptone, etc., eventually with 1 egg, 125 gm. hashed chicken breast, sweetbreads, fish (pike, fresh herring, trout, perch, fresh flounder), 75 gm. potatoes or chestnut purée.

4 *o'clock*

250 c.c. acorn cocoa.

6 *o'clock*

250 c.c. kefir, three days old, or
milk with lime-water, or
2 parts milk and 1 part cream.

8 *o'clock*

250 c.c. soup with peptone, eucasin, etc. Eventually, tea with sugar and milk, 100 gm. buttered toast.

10 *o'clock* P. M.

180 c.c. milk, kefir, or grits, or meal soup with crackers, 30 to 40 gm.

This diet supplies about 2000 to 2200 calories. Rosenheim gives the following 5 meals for chronic enteritis with diarrhea:

1. 100 gm. beefsteak, 100 gm. white bread crusts, 10 gm. butter afterward, 100 gm. tea.

2. 60 gm. ham, 50 gm. zwieback, 1 glass red wine, after 1 hour 200 gm. soup, 100 gm. white bread, 10 gm. butter.

3. 100 gm. acorn cocoa, 1 egg, 50 gm. zwieback.

4. 100 gm. roast meat, 100 gm. vegetables, 1 glass red wine; after one hour 300 gm. soup, 100 gm. bread, 10 gm. butter.

5. 50 gm. zwieback, 5 gm. butter, 50 gm. ham, 1 glass red wine.

In regard to the use of astringents it must be said that their effect is usually neutralized before they reach the place where it should be exerted, *i.e.*, the large intestine (bismuth preparations, tannin, silver nitrate, lead acetate). In tannalbin Gottlieb found a drug which gives up its tannic acid only in the lower part of the intestines, whereas tannin is fixed by the proteins in the upper part of the intestines; in adults it is given in doses of 1 gm., in children in doses of 1/4 to 1/2 gm., several times a day. In the same way tannigen and tanocol, bismuth subnitrate and salicylate, bismuthose, and dermatol are given. Orphol (β-naphthol bismuth), mixed with calcium phosphate and calcium carbonate in the proportion of 5 : 40 : 60 given in knife-point doses several times a day, gives good result in some chronic diarrheas (Boas). Ichthoform and ichthalbin are praised by others, especially as removing flatulency promptly. Tinctura coto, cascarillæ, rathaniæ, and extr. colombo are other styptics. W. Zweig praises the folia psidii pyriferi, which is in high esteem as an antidiarrhetic in the tropics.

Rp. Fol. psidii pyriferi, 10.0:150.0
Tannigen,
Bismut. salicyl., āā 5.0
Syrup fœniculi, ad 200.0
DS. Shake before using. One tablespoonful every two hours.

If we use Karlsbad water in the treatment of chronic enteritis with diarrhea, it should be given, according to Nothnagel, three times a day in small quantities, 30 to 50 gm., before meals. It must be drunk warm, as otherwise it increases the diarrhea.

Jaworski recommends chalk in carbonic acid waters, as calcium carbonate and calcium salicylate āā 2 c.c. in 1 liter of water saturated with CO_2.

Washing out the intestine with luke-warm Karlsbad "Mühlbrunn" or with astringents, may be tried. Pentzoldt prefers the addition of tannin to the enema, 1 teaspoonful to 1000; silver nitrate (0.3 : 1000); and boric acid 3 : 1000, or a bismuth emulsion, 5 : 250, may be tried. The pressure exerted in applying the enema must be low, but the rectal tube should be introduced high. The patient takes best the left lateral position, with the legs adducted, or the knee-elbow position.

Hydrotherapy may be an efficient means in combating diarrhea; the cold Sitz-bath used for ten to fifteen minutes is much in favor; during it the patient has to rub the abdomen vigorously. This procedure must not be carried out in a mild way, as a less cold and a short bath stimulate peristalsis rather than moderate it. This bath is very suitably followed by a cold rub.

Diarrhea of Infants.—We shall now give the antidiarrheic régime in infants, as far as this is possible without considering the quality of the stools. The diet and the question whether laxatives or even styptics are indicated are to be decided above all by the picture of the stools. However, if fever exists, and a severe intestinal affection can be excluded, it will indicate that the whole toxic material has not yet been removed. If the intestinal channel is completely emptied, salicylate of bismuth 5 gm. : 100 may be prescribed in the form of a mixture to be shaken before use, and, according to the age of the infant, 1/2 to 1 drop of the simple tincture of opium may be added. One teaspoonful of this mixture may be given every two hours without fear of intoxication. Great caution must be observed in the use of atropin, which doubtless diminishes the secretion in profuse diarrhea. Escherich advises to give great attention to the first symptoms of atropin intoxication which are observed rather frequently, as mydriasis, tachycardia, erythemas, and sudden rises of temperature. In this way serious results may be avoided.

Escherich prescribes:

Rp. Atropin sulphur., 0.01 : 10
DS. One to two drops in 50 c.c. water, to be used during one day.

The great sensitiveness of small children to opium may be again emphasized here, and the maximal doses for the simple tincture of opium, which have been found harmless, given:

Under 1 year,	up to 1 drop.
1 to 2 years,	2 drops.
3 to 4 years,	3 drops.
5 to 6 years,	4 drops.
6 to 10 years,	5 drops.

In older children one may proceed more confidently and give a fourteen-year-old child half the dose for an adult. The extract of opium is best avoided in small children.

Of astringents we may name tannalbin (0.25 to 0.5 gm. two to four times a day), tannigen, tannoform (0.25 gm. three to four times a day), tannopin, a condensation product of tannin and urotropin, and tannotol. Rad. colombo may be given as infusion or decoction, 2 : 100, 1 dessertspoonful every two hours, and tincture of ratanhia or tincture cascarillæ xv drops : 70 c.c. in the same dose. They are all useful as vehicles for the opium tincture.

Dehydration in Infants.—The loss of water occurring in the severe gastroenteritis of infants must be compensated by infusion of physiological salt solution. This exsiccation may be recognized by the

sunken fontanels and eyes, by the overlapping of the bones of the skull, so that the sutures form a ridge, and by the persistence of the folds caused by pinching up the skin. More or less cardiac weakness is always present. The great fatigue and muscular weakness leads to peculiarly slow stiff movements of the child, and may be recognized in the feeble, hoarse voice. The pulse is weak and very frequent; the peripheral parts are cold to the touch and livid. The urinary secretion threatens to stop entirely, the tongue and mouth are dry, the abdomen is not distended, but of a peculiar, pasty consistency.

By infusion of 150 to 200 c.c. physiological salt solution given in the infraclavicular region or laterally in the abdomen, the tormenting thirst of these children may be satisfied, the cardiac force improved, though only transiently, and at the same time the urinary secretion stimulated, and thereby a greater quantity of toxins eliminated from the body, and these greatly diluted, so that the kidneys are not unnecessarily irritated.

The treatment consists in tea diet, calomel, stomach and intestinal lavage; on beginning convalescence, astringents may be used.

The prognosis will always be doubtful if the condition above described has once developed, and entirely unfavorable if the collapse has progressed far. Henoch mentions that just when the end is near vomiting and diarrhea decrease or cease entirely, deceiving the parents who begin to regain hope. The prostration progresses and leads to death with the symptoms of hydrocephaloid; in young infants, sometimes with the picture of sclerema, with disappearance of all adipose tissue (Henoch).

B. CONSTIPATION AND OBSTRUCTION

General Remarks.—By constipation we understand that condition in which defecation does not occur every day, but only after several days, or where it is necessary to bring it about by special measures, as cathartics, irrigation, etc.

There are, however, many healthy individuals in whom the bowels move every second or third day without the appearance of any pathological manifestations. In many cases constipation is the cause, or an accompanying symptom of other disorders. According to the severity of the manifestations we distinguish constipation from obstruction, the latter being that form of constipation caused by a mechanical hindrance to the movement of the feces, and which may lead to very dangerous conditions. The normal defecation depends on the normal course of the intestinal peristalsis, and on the muscular action necessary for the excretion of the feces, provided that the passage of the ingesta through the whole digestive canal is undis-

turbed. From this there results the greater number of disturbances which produce constipation.

It deserves to be mentioned that there are forms of constipation in which a daily movement of the bowels occurs, but in which, nevertheless, some residua remain daily in the bowels, and from whose accumulation and decomposition severe conditions may suddenly arise. Such a case is described in the literature with a fatal end due to the perforation of a stercoral ulcer.

The various forms of constipation may, according to Nothnagel, be divided into primary and secondary constipation; the latter may be brought about by changes in the physiological factors and by morbid processes.

Constipation from Physiological Causes.—Let us first consider the physiological causes of constipation:

The Food.—Insufficient ingestion of food leads to constipation, though the starving individual is able to defecate, as has been observed in starving artists and patients mentally affected.

If a breast-fed child shows sluggishness of the bowels it will be a hint to control the quantity it eats; often one will find that this is insufficient. The same effect is brought about on vomiting of all food taken in, as may be observed sometimes in severe cases of whooping cough. A sufficient consumption is another condition *sine qua non* for regular bowel movement. If children are changed from milk to solid food and one neglects to give them water to drink regularly, obstinate constipation may be provoked. On the other hand, a great loss of water leads to thickening of the feces and to constipation. This may be observed after extensive sweats with great regularity, after mountain tours, in diabetes mellitus and insipidus—conditions in which even stercoral colic may arise.

The quality of the food is of great influence. This is seen from the first in infants whose bowels are much more regular if they are breast fed than if bottle fed. Cow's milk is too poor in fat and leaves more residua after digestion than the intestine of the new-born with its feebly developed muscularis can easily handle. Children nourished with cow's milk have stools only once a day, whereas breast-fed children have three or four. The cow-milk stool is often dry and falls from the napkin without leaving any traces, which is due to the high content in the earthy-alkali soaps, whereas the human-milk stool is soft, like ointment.

The constipation of the artificially fed child is relieved by enriching its food with fat if severe disorders can be excluded. One adds cream to the milk or lets fresh butter dissolve in it; fat, if emulsified, is sometimes well tolerated, whereas it sometimes causes disorders if it is not (butter, cod-liver oil).

A mixture of milk with veal broth (made from lean veal without bones, with the addition of salt) is sometimes of good effect, as well as milk sugar and milk malt soup, after the old prescription of Liebig, or as modified by Keller. Amylaceæ are better not given too freely. Gärtner's fat milk, too, has the advantage of preventing constipation.

Breast-fed children may become constipated if their nurse suffers from this trouble, or if she menstruates. The milk is changed in some as yet unknown way. Possibly the decrease of the milk secretion during the menses may be the pathogenetic factor.

In the farther progress of childhood constipation often persists; this may depend on the fact that the children are very poor eaters and that they get food which is too poor in residual matter. The parents try to improve the condition of these delicate, anæmic children by a nourishing light diet, giving them chiefly meat, eggs, and milk. In this way, through the absence of stimuli, are produced loss of appetite and atony of the stomach and intestines. Heubner advises supplying such children with a great quantity of cellulose in the form of spinach, carrots, purée of peas, green beans, etc.

The success with reference to the appearance, feeling, appetite, and stools is often surprisingly good in such cases.

Also in adults, the exclusive use of milk or meat as principal foods leads to constipation. In such cases, if other causes do not forbid it, one adds to the food coarse cellulose, as graham bread, and accomplishes in this way the desired result.

Insufficient Muscular Action.—The intestinal musculature may primarily be insufficiently developed, as in premature and debilitated children; they are almost constantly constipated as long as they have not acquired any digestive disturbances which lead to diarrhea. The weakness of convalescents after severe exhaustive conditions, as typhoid fever, frequently leads to constipation, especially if the intestinal wall has been directly or indirectly involved in the affection (dyspepsia, peritonitis).

General weakness of the skeletal musculature may at first render defecation difficult, leading to obstinate coprostasis. In atrophic infants and rachitic children in the first years of life, weakness of the abdominal muscles causes constipation.

The flabbiness of the abdominal muscles finds its expression in the frog belly or in the "three-hill" belly; in the latter condition three protrusions may be recognized on the active sitting up of the child, one in the diastasis of the rectal muscles, the other two laterally. The treatment of rickets with phosphorus cod-liver oil also acts favorably on the constipation.

It is well to know that many people who otherwise are very regular in their bowel movements are at once constipated if they are

obliged to stay in their rooms or in bed. A sufficient action of the muscles, especially of the diaphragm and of the abdominal walls is not only of direct importance for defecation, but, by varying the intraabdominal pressure, it produces stimuli for peristalsis. In this way its absence leads to coprostasis. For the same reason constipation is a disagreeable sequela of a sedentary life, disappearing often during a sojourn in the country in vacation time, only to return again when the patient assumes his customary occupation.

Primary Pathological Constipation.—Different Forms.—Before discussing the secondary forms of constipation in the different diseases, we shall speak of that condition in which constipation is the only, or at least the most important, symptom—primary constipation.

First, the congenital changes in form and position of the intestines may represent the cause for habitual constipation. In the first place we must consider the colon, whose function is the most important in the formation of the stool.

Abnormal length of the colon may cause chronic sluggishness of the stools, especially in those cases in which the transverse colon and its mesentery are abnormally long, hanging down into the pelvis. The sigmoid flexure may be found enormously developed at postmortem in persons who have suffered all their lives from constipation. Curschmann believes this finding to be a congenital anomaly, and not a sequela of coprostasis.

Congenital dilatation and hypertrophy of the large intestine may also be the causes of constipation.

Hirschsprung in 1886 demonstrated two cases of this kind in Berlin, and since this time this finding has proven a not very rare condition. Marfan considers this condition to be caused by an abnormal formation of the sigmoid flexure, and Göppert found in one case a kinking of the sigmoid at its juncture with the rectum. The success of his treatment proved the correctness of his conception. The introduction of a thick intestinal tube to a point above the place of kinking relieved at once the discomfort which consisted in obstinate constipation and meteorism. Lasting recovery was accomplished by leaving the tube *in loco* for several months; high enemas with large amounts of liquid give good results in Hirschsprung's disease. Cathartics cause rather an exacerbation of the condition.

Chronic constipation may often be traced back to anatomical changes in the mesentery, according to an opinion ventured by Voetsch. Leichtenstern combated this conception successfully. He showed that displacement of the transverse colon may exist without causing any disturbances, and believes that the accumulation of feces in many cases has not to be considered as the cause but as the result of the disease.

Glenard places on enteroptosis the chief weight in the pathogenesis of chronic constipation. According to him there exists a ligamentum pylorocolicum which extends from the pylorus to the transverse colon and which, on sinking down of the stomach, produces kinking of the transverse colon. The large intestine, according to this view, is filled with feces as far as the point of kinking, from there down it is an empty tube. Though this anatomical explanation has not much proof, enteroptosis is certainly the cause of constipation in the constricted thorax due to corsets.

Habitual Constipation.—Habitual constipation depends often on a congenital, often on an inherited, abnormal function of the peristalsis of the colon and rectum. Sometimes a certain inciting factor may be traced which once caused constipation, and since this time the nervous disturbance had remained. In some cases it is a depressing mental impression, then again the necessity to hold the stool back for a long period, or an abnormal thickening of the stool by profuse sweating, and from the time of these occurrences the peristalsis continues its newly acquired habit. Whether we have hereby to deal with a pure disturbance of innervation or with a real atrophy of the musculature of the colon and rectum is difficult to decide; at any rate, a uniform pathological condition is by no means proved.

Neurasthenic and hysterical patients often suffer from constipation. This connection is not to be explained on the basis of the nervousness, this being rather the consequence of the constipation; nervous people are especially easily affected by sluggish stools. A connection with sexual neurasthenia is sometimes unquestionable; in children, some forms of obstinate constipation can be traced back to masturbation (Baginsky).

In neurasthenics the spastic form of constipation is especially frequent, according to Fleiner. In this the intestine has no peristaltic action, but is in a state of chronic contraction; the scybala are held back entirely or, in lighter cases, they pass in the form of little balls or rods (similar to sheep's excrement). If the feces have such a configuration, the suspicion of mechanical stenosis may arise. This enterospasm may affect the whole of the small intestine and bring about the navicular retraction of the abdomen, which occurs in organic diseases of the brain.

Diagnosis between the atonic and the spastic form is best made by giving an irrigation and observing if the splashing sounds are soon to be heard farther upward, and if the patient is able to retain a large quantity of water, about 1 liter, for some time. Both factors speak for the atonic form. By voluntary retention of the stools, the tonus of the sphincter may be permanently increased in comparison with that of the levator ani, and this disproportion may lead to chronic consti-

pation. Manual stretching of the sphincter eight or ten times may adjust this condition in a striking way. G. Singer has recommended rectal bougies with the same aim.

The same condition is found in nervous children, and in others who during their play forget the necessity of going to stool, and finally in persons who suppress their stool from an hysterical sensation of disgust.

Another form of functionally disturbed intestinal activity is the pseudometeorism (Raplan), which may simulate an anatomical disease. It is due to a deep position of the diaphragm, with a simultaneous protrusion of the anterior abdominal wall, corresponding to the position of maximal inspiration. The general condition is undisturbed, and the grotesque picture may disappear in a short time without any passage of gas. In some cases we have to deal with true inflation of gas, due to great quantities of swallowed air. If this condition is associated with obstinate constipation, the unjustified suspicion of severe disease may arise.

Consequences of Constipation.—The first and chief complaint of the patient in all the conditions mentioned is usually the sluggishness of the bowels. This, however, causes other disorders, which disappear as soon as the constipation is removed. The patients complain of a sensation of fullness in the abdomen, and of pain in the sacrum. Symptoms arise on the part of the stomach, as loss of appetite, coated tongue, a bad odor from the mouth, and a sense of pressure in the stomach after meals, headache, dizziness, general irritability, and exhaustion.

Sometimes the classical picture of hypochondria develops. Whether melancholia and other depressing psychoses are due to constipation is doubtful. Constipation is in such cases generally only a symptom which belongs to the cerebral affection.

The disposition, especially in children is unfavorably influenced by constipation. In children, elevations of temperature readily develop, which promptly disappear after a laxative has been given.

The objective findings in constipation consist sometimes in the presence of scybala, especially in the left iliac fossa, and in a relative dulness on both sides of the abdomen. The form of the feces is not always the same. Sometimes scybala as large as plums are evacuated, molds of the atonic haustra coli, or the typical feces of stenosis, found also in the state of starvation and in carcinomatous cachexia.

A farther reaction on the part of the intestinal tract consists in a mucoid or serous secretion, rendering the stools slippery. The so-called varnished stools, according to Nothnagel, are not to be considered as signs of an intestinal catarrh, but the hard fecal masses may irritate the intestine severely, so that stercoral diarrhea,

even of long duration, may develop. Stercoral colic is not infrequently caused by the spastic contraction of the intestine above the accumulation of feces. Through stretching of this part of the intestines, nutritive disturbances of the mucosa may be produced, which, with simultaneous pressure of the scybala, may lead to necrosis and ulceration. A local irritation of the peritoneum and even perforation with diffuse peritonitis may be produced.

Very much thickened fecal masses may form coproliths; they do not necessitate any complete obstruction of the passage, since they are formed in the haustra and the intestinal contents may move centrally. Sometimes, however, intestinal stenosis and occlusion may be brought about in this way.

Intestinal loops, filled with fecal matter, by sinking downward may produce another form of disturbed passage. The transverse colon may fall to the symphysis, leading, by compression or kinking, to intestinal occlusion.

Other sequelæ of chronic constipation are rectal prolapse, rectal fissures, hemorrhoids, and umbilical and inguinal hernias—conditions which of themselves may again increase constipation by rendering defecation painful and in this way produce an inhibitory action.

Constipation is frequent in the course of pregnancy, in retroflexion and retroversion of the uterus, after sutured peroneal lacerations, operated vaginal prolapse, etc. It is of great influence in female genital diseases, which are much more painful if the cavum Douglasi is filled with feces. Küster observed the occurrence, of fever, after gynecological operations, which promptly disappeared after evacuation of the intestines. This influence of the intestinal function on the temperature is to be explained by the resorption of pyrogenic substances increased by the pressure of the fecal tumors (autointoxication).

The emaciation which sometimes follows chronic constipation is probably the consequence of the disturbed metabolism, as recent experiments on the dog show (Glaessner with B. Krauss).

There are two theories of the true cause of the injury from constipation. Some regard it as a reflex action, others ascribe it to the absorption of toxins. Dunin emphasizes rightly that the toxins which have been demonstrated by Bouchard can be much more readily absorbed from liquid stools than from solid ones. This point of view is also taken by Nothnagel.

Federn sees, in "partial intestinal atony," the cause of many forms of constipation as well as of other intestinal and nervous diseases. On slight percussion he constantly finds at a certain point relative dulness and gives laxatives in the acute forms until the dulness

has completely cleared up. In the chronic form he recommends faradization.

Treatment of Chronic Constipation.—In the treatment of chronic uncomplicated constipation we must guard against the too frequent unmethodic use of laxatives.

In neurasthenics who complain constantly of their constipation, it is best not to treat this symptom at all, since the attention of the patient would be constantly centered on this condition, only rendering it worse.

One tries to improve the general neurasthenia by a change of climate and hydrotherapy. The patient must be convinced that his trouble is of very little importance, and in this way constipation founded on inhibition disappears of itself.

If cathartics are not entirely necessary they would better be avoided. Rather, according to Fleiner and Ebstein, 1/4 liter of oil at 28° to 35° C. may, under slight pressure, be slowly injected in the evening. Patients usually retain this quantity over night. Nervous people, whose night's rest may suffer from this, receive better a larger injection in the morning, retaining it as long as possible. These oil enemas must be continued for weeks. Massage, which otherwise gives such excellent results, is rather a disadvantage in the spastic form of constipation.

Dietetic.—The most important factor in the treatment of constipation is the diet. A one-sided meat diet produces constipation, perhaps because only a small amount of feces is formed on account of its good resorption, or because the decomposition products have a paralyzing action on the motor nerves of the intestine (Ewald). Exclusive vegetable diet, on the other hand, produces too large quantities of feces, and in this way constipation, since the intestines are not able to move such large masses forward. Mixed food is therefore the right diet. Penzoldt recommends the following menu:

7 A. M. One glass cold water.

8 A. M. An abundant breakfast with sugared coffee, much butter, honey, graham bread or pumpernickel.

1 P. M. Meat, much vegetables, salad, compote, pudding, and half a bottle of light wine (Moselle or apple wine).

7 P. M. Meat, much butter, graham bread, compote, and beer.

10 P. M. Fresh fruit or compote.

Kefir one day old has a slight laxative action.

In prescribing the diet one must distinguish whether the atonic or spastic form of constipation is present. For the first, one gives a mixed diet, much fruit, sour milk, honey, etc., leaving out the coarser kinds of cellulose (radishes, cucumbers, cabbage, black bread). In

the spastic form we have to place great emphasis on fat in all forms. Grape-cures sometimes render excellent service.

Physical.—The diet is very effectually aided by mechanical treatment.

In massage we first make use of effleurage (stroking movement) to remove the tension of the abdominal walls; then we employ labile kneading along the course of the colon (petrissage), finishing with vibrations and hacking movements. This procedure must be repeated every day after meals for several weeks. In the beginning irrigation may also be used, but in the farther course of the treatment this becomes superfluous.

For the massage of children Heubner recommends the following four acts:

1. By spiral motions with the finger tips one makes a movement as if to crush the fat lobules of the subcutaneous fat.

2. One kneads the recti muscles downward, taking them between the thumb and the index finger and middle fingers.

3. The lateral abdominal muscles are worked down by spreading the palms of the hands flat on the abdomen and stretching the thumbs until they touch at the median line.

4. One makes stroking movements along the colon.

For the massage of children, the use of an iron ball covered with leather has been recommended, the weight varying according to the age. It is rolled in the direction of the hands of a watch round the umbilicus.

The practice of gymnastics is very useful, especially if the exercises involve the abdominal musculature. The patient lies flat on the mattress, and with the arms folded raises his body to a sitting position, then with knees stiff he bends his legs at the hips as far as possible. The Swedish gymnastics, swimming, rowing, and riding are to be recommended.

Williams and Ewald recommend in defecation instead of a sitting position, the squatting position, in which the abdominal muscles are much more effective.

Faradization of the abdominal walls is usually preferred to galvanization. Nothnagel and others deny its usefulness, others as Boas and A. Pick are convinced of its favorable effect.

The increased tonus of the abdominal wall is certainly of value in many cases. In children, however, this method is not advisable. Thus Neumann observed in a healthy, though constipated breast-fed child, intussusception following faradization, a condition which may be produced experimentally in animals. This proves that not only the abdominal muscles but the intestines themselves, are irritated by the current. Leubuscher uses the galvanic stream, introducing

one electrode into the rectum. Others prefer the galvano-faradization or the intrarectal faradization. In hemorrhoids, proctitis, and rectal fissures, which are by no means rare in chronic constipation, these rectal methods are unquestionably contraindicated. Also in Hirschsprung's disease faradization of the abdominal wall is sometimes advisable.

Of a peculiar type is the constipation in chlorosis. It is often improved by a rest cure, from the improved quality of the blood.

The cold-water treatment aids effectually the other procedures directed against the atonic form of constipation. Cold rubs followed by sitz-baths of 12° C. for five minutes, half-baths with high showers over the abdomen, especially the Scotch shower-bath, have a stimulating action. Boas recommends the ether spray: 100 c.c. of pure ether are daily evaporated on the skin of the abdomen by means of a spray. The cold produced by evaporation causes the desire to defecate.

In spastic constipation our measures must be sedative.

Baths of 37° to 40° C. may be followed immediately by bowel movements. A Leiter apparatus filled with warm-water thermophores, warm sitz-baths, and warm showers have the same effect. Also, in the form of enemas, heat has a spasm-relaxing action, as may be observed following irrigations at 45° C.

Trousseau called attention to a rational procedure. The patient must try to go to stool every day at the same hour, in this way educating the intestines to regular activity. In light smokers a cigar is often of good service.

Evacuation by Rectal Methods.—Evacuation of the intestines by rectal methods is the most frequently used physical method. Especially in small children, but sometimes even in adults, the removal of accumulated fecal masses from the ampulla of the rectum with the finger or a special instrument may become necessary. Usually the emptying by enema is sufficient, and its action may be varied according to the quantity, pressure, and temperature of the liquid and to the use of additional drugs.

Ice-water is a strong stimulus, also the addition of vinegar, about 1/4 of the liquid used, green soap in 1 per cent. solution, or 1 tablespoonful of Glauber's salt or castor oil to one enema. Very effectual is also the following emulsion:

250 gm. luke-warm water.
2 tablespoonfuls castor oil.
2 tablespoonfuls glycerin.
A piece of soda as large as the end of the finger.

Oil enemas (Ebstein) have already been mentioned. Heubner recommends them also for children, once or twice a day, using 30 to 50 c.c.

Especially in pediatric practice, small enemas with glycerin (2 to 3 gm.) are very much used; or suppositories of soft soap, or of the following composition.

Rp. Glycerin, 2.0
Butyr. cacao, 3.0
Ut. Fiat supp. V.

Flatow insufflated 3 gm. boric acid into the rectum, and accomplished good results by it, and this F. Merkel confirms, especially in existing flatulency.

Cathartics are to be used only when all other methods fail; the mildest should be used, and frequently changed in order to avoid habit.

Some drugs, as rhubarb, have the property of producing constipation after the laxative effect. They should be given only in combination with other drugs. Calomel, whose action is founded on the freeing of small quantities of corrosive sublimate, should be followed by another sure cathartic, if its action is not prompt, as otherwise a disagreeable stomatitis may be observed, due to acute mercurialism. Nothnagel warmly recommends:

Rp. Podophyllini, 0.5
Extr. aloes,
Extra. rhei, āā 3.0
Extr. Taraxaci q.s. ad pilil Nr. XL.
One to four pills at bedtime.

Sulphur, in the form of its flowers, given in knife-point doses, is a very mild laxative. It is one of the constituents of compound licorice powder, and acts through the formation of H_2S, which stimulates peristalsis.

In the same way:

Rp. Sulphur depurat.,
Natr. tartar, āā 10.0
DS. In knife-point doses.

Of mild action are the pulp of the tamarind, marmalades, manna (mannit), compound licorice powder, neutral salts, and castor oil.

Of stronger effect are: Infusion of senna, 10 : 150; resin of jalap, 1 : 2, or phenolphthalin, of which children receive 0.05 gm.; adults, 0.1, given two to three times a day. The fear of setting free phenols, and thereby producing intoxications, is unfounded. Purgen (phenolphthalein rubbed up with milk-sugar), for infants 0.025 to 0.05; in older children, 0.15; in adults, 0.1 to 0.3. Purgatin (anthrapurpurin-diacetate), in doses of 0.3 to 0.5, irritates the kidneys and is therefore not to be recommended.

Exodin (chiefly diacetylrufigallic acid tetramethyl ether) has been

recommended by Ebstein, 0.5 for children and for adults 1.0 gm. Regulin (agar-agar), a teaspoonful added to vegetables or apple sauce.

For longer use, calcined magnesia, magnesia sulphate, and the effervescent citrate, as well as rhubarb, are all suitable, but cascara sagrada, syrup rhamni cathartici, one teaspoonful two to three times a day, until action, Karlsbad salts (genuine as well as artificial), and bitter waters are preferable. Cures at watering-places have no persistent effect, for, on returning to the usual conditions, the old evil appears again.

Roos' treatment of constipation is interesting. He gives coli bacilli, lactic acid bacilli (Metchnikoff), Kefir, and yeast, and has seen very good results. Yeast is said to be effectual even after sterilization. He gives 1/2 gm. of dried, finely pulverized yeast, two to three times a day.

Raviart and Bertin obtain a mild and agreeable laxative action by the subcutaneous injection of apocodein hydrochlorate in doses of 0.02 gm.

Physostigmin, the active principle of the calabar bean, is also stimulating in its action on the intestines, though our experience with this drug is as yet insufficient.

If stercoral colic develops, we must first give opiates or belladonna preparations until we are undoubtedly convinced that no serious condition is present; only then may cathartics be given; for instance, adding belladonna to the above-mentioned podophyllin pills (Nothnagel), as:

Rp. Podophyllin.,
Extr. belladonn., āā 0.5
Extr. aloes,
Extr. rhei, āā 1.5
Pulv. et Extr. liquirit q. s.
ut fiat pilul Nr. XXX.
DS. One pill in the evening.

In spastic constipation, cathartics are directly injurious. Sedatives, as opium, belladonna, bromides, etc., have to be given. For instance:

Rp. Extr. belladonn., 0.01
Butyr. cacao q. s. ut f. suppositor.
DS. One to two suppositories.

or by mouth:

Rp. Magnes. ustæ,
Elæosacchar menth., āā 0.25
Extr. belladonn., 0.01
M.f.p. D. tal dos. Nr. XII.
DS. Two to three powders daily.

The contraindications for drastic purgatives are the following (H. Kionka):

1. Danger of intestinal hemorrhage and perforation.

2. Inflammatory diseases of the intestines and peritoneum, which demand absolute rest.

3. Old people and weak anemic individuals, who suffer from the exsiccation due to the action of drastics.

4. Menstruation and pregnancy, in which the use of powerful cathartics threatens menorrhagia or abortion.

Secondary Constipation.—In Febrile Diseases.—Constipation is a concomitant symptom of many acute febrile diseases, as, for instance, pneumonia and typhoid fever in the first week.

Different causes act together in its production. The nonstimulating food, rest in bed, the loss of water, and the diseased secretion of the digestive glands. In some cases, perhaps, irritation of the splanchnic nerve, as the inhibiting nerve of the intestines plays an important part.

The experience of the old physicians that it is good to remove this constipation is certainly true to some extent. The patients feel freer and fresher when their intestines are evacuated. But the old proverb, "qui bene purgat, bene sanat," must not be pushed so far that we produce a profuse diarrhea, which certainly leads to weakening and injury of the general condition.

In Stomach Diseases.—In acute gastritis, constipation often exists in the first few days, though in many cases diarrhea is present, namely, when the catarrhal changes of the mucosa spread over the whole intestinal tract. If the bowels are sluggish, we should give laxatives which do not irritate the gastric mucosa; for instance, castor oil.

In chronic stomach affections, as gastric atony, which are frequently associated with intestinal atony, the patients complain of constipation along with their other symptoms.

In hyperacidity, but also in hypochlorhydria, constipation is frequently observed. The explanation of this is not simple. It is believed that on an excess of free HCl the antiseptic action of the gastric juice is too strong, and that too few decomposition products are formed during digestion. Some authors blame the absence of lactic acid; others, and probably with more justification, the absence of the development of CO_2, as carbonic acid is recognized as a great stimulus to peristalsis (Riegel). On a decreased production of HCl the constipation is traced back to an excessive development of decomposition products, and the proof for this may sometimes be brought *ex juvantibus*, for, by administering antifermentatives, a regular bowel movement may be produced.

Constipation is also observed in ulcer of the stomach, sometimes associated with other neurasthenic troubles, as headache and vertigo. In these cases constipation may be connected with hypersecretion. v. Leube, in earlier years, ascribed to the hindered secretory and motor function of the stomach the cause of the constipation, though these functions are intact in many cases of gastric ulcer. But he rightly points out that the food taken in is very little, since the patients, from fear of pain, are afraid to eat, though the appetite is good, and that, on the other hand, a great part of the food taken in is often vomited. In the further course there develops more or less severe secondary anemia, a condition which *per se* is very frequently associated with constipation.

Bouveret considers constipation as a reflex inhibition due to irritation of the sensory gastric nerves. It is clear, *anticipando*, that pyloric stenosis constantly leads to constipation, as the passage of the chyme into the intestine is hindered, and it is therefore an important diagnostic sign of congenital pyloric stenosis. If an infant vomits very frequently, one will think, in general, of dyspepsia, which leads to the characteristic dyspeptic stools, and on longer course to enteritis and diarrhea. If, therefore, we are told that the bowels move only rarely and in very small quantities, the suspicion that a pyloric stenosis is the cause of all the trouble is well founded.

In Jaundice.—In catarrhal jaundice we frequently find constipation, whether it is from absence of the stimulus which the flow of the bile into the intestine exerts on the peristalsis or from an acute catarrh of the upper part of the intestines, which is usually associated with catarrhal icterus.

In Intestinal Diseases.—The acute catarrh of the small intestine leads rather frequently to sluggishness of the bowels; if the large intestine is normal, the diagnosis of a jejunal catarrh is in such cases only possible if the dry stools are carefully examined for mucus intimately mixed with it.

Atony of the Intestines.—Acute catarrh of the whole intestinal tract is usually not associated with constipation, but atony of the intestines is. In this condition the patient complains of pressure in the head, dizziness, neuralgia, sleeplessness, and migraine; and atony may be objectively proved by a slight meteorism and the high position of the diaphragm. Many cases of chronic costiveness are certainly due to this condition. In nervous, anemic overzealous school children we often meet an obstinate constipation, which to some extent is certainly due to atony. These children have very small appetites, and food must be forced upon them. In such cases we must attend to it that the children take a substantial breakfast before going to school and that, on returning, they do not sit down at the table at

once, fatigued from their mental work at school and the walk home. They should rest half an hour before they eat. Remedies stimulating the appetite and iron preparations shall be given, tincture amara and tincture ferri pom., āā 20 gm. to 10 drops three times a day, or wine of Condurango, a liqueur glass half an hour before meals. In Heubner's clinic is prescribed:

Rp.	Ferrum pyrophosph. cum Ammonia citrica,	2.5
	Aqu. dest.,	100.0
	Syrup. cort. aurant.,	20.0
	DS. 10 c.c. two to four times a day.	

Heubner has a beaker of quassia wood filled with water and allows it to stand for one-half to three-fourths hour, and then gives it to the child to drink.

If all these measures are fruitless, then there remains nothing further to do than to take the children out of school for a few weeks; during this time they can take a Karlsbad cure, drinking perhaps about 4 tablespoonfuls of Mühlbrunn, two to three times a day before meals. Walks in the fresh air and abstinence from all mental labor work together in bringing about complete recovery soon. Unfortunately, in many cases a relapse occurs as soon as the child goes to school again.

Chronic Intestinal Catarrh.—The chronic intestinal catarrh, involving the small or large intestine or both, is very often accompanied by constipation, which is sometimes interrupted by attacks of diarrhea. The spreading of the process from the mucosa to the musculature and the affection of the nervous apparatus of the intestines explain in a natural way the appearance of constipation. The diarrhea is due in most cases to small errors in diet or to decomposition of the stagnant intestinal contents (stercoral diarrhea).

The therapy of constipation in the course of chronic enteritis is therefore a rather difficult one, for on the one hand we have to combat it and on the other hand we should avoid everything that irritates the intestine. The usual therapy of habitual constipation, namely, a coarse, irritating diet, would not be advisable in these cases. We will cautiously advise fine cellulose, apple purée, spinach, etc., and fat in the form of butter.

Also in regard to the medicinal treatment we are somewhat hampered. Drastics or even infusion of senna or calomel may considerably increase the intestinal catarrh. The saline cathartics are best used in the form of Karlsbad salts or mineral waters. Karlsbad water, if taken cold, usually has a slight laxative effect, which may be still increased by dissolving in it some Karlsbad salt. Many other mineral waters have a similar effect. The examination of the stools

proves that, on the use of these cathartics, the secretion of mucus is not augmented, which means that they cause no exacerbation of the catarrh. Oil enemas, too, in this form of constipation are often advantageous.

Membranous Enteritis.—Enteritis membranacea occupies a peculiar position, Boas regards it as a special form of the catarrh of the large bowel, while others believe it to be a functional neurosis. Both explanations are probably right in many cases. Where a chronic intestinal catarrh is gradually transformed into a membranous enteritis, the former may still persist as the anatomical foundation, even when the typical picture of the latter has developed. In other cases, of primary origin, we have, in fact, probably to deal with a secretory neurosis of the intestine, and the characteristic masses of mucus, expelled in the form of bands, are probably produced by the mucus accumulating in the longitudinal folds of the large intestine during the chronic spasm and becoming inspissated by resorption. According to v. Noorden's; and Dapper's experiments, a coarse diet which irritates the intestine is, then, of much better service than the bland form which has been kept up in those cases often for years.

Ulcers of the Intestine.—Dysenteric ulcers in the course of a chronic dysentery sometimes give rise to chronic constipation.

Tumors of the Intestine.—In regard to neoplasms we have to distinguish sharply between carcinoma and sarcoma.

Sarcoma, especially lymphosarcoma, does not necessarily produce constipation. In the part of the intestine affected dilatation of its lumen may even exist, as Madelung and Mältzer have pointed out.

If a disturbance in evacuation arises, it usually develops rapidly into a very threatening condition. In these cases we may have to deal with an invagination, volvulus, or a paralytic ileus (Kraus).

In carcinoma it is different, as it is usually annular, and obstructs in this way the intestinal lumen. For a long period the bowels are sluggish, until one day severe manifestations of intestinal stenosis arise. A temporary improvement of the constipation must not deceive the physician; its cause lies in the exulceration of the tumor, the same as occurs in carcinoma of the esophagus, temporarily improving the difficulty of swallowing. In these cases tumor tissue may sometimes be found in the stools, but generally this will not be the case, and the diagnosis must be made by the findings on palpation, by the anamnesis and by the demonstration of blood or pus in the feces. It is always a suspicious circumstance and one urgently demanding careful examination, if a person over fifty years old without apparent cause is taken with symptoms of constipation and loss of blood in the stools. It is a grave mistake in such cases to be satisfied by the diagnosis of constipation and hemorrhoids. A thorough

digital examination of the rectum, in women also of the vagina, must be performed.

In regard to the differential diagnosis of cancer in the small or in the large intestine, the position coincides in general with the localization of the intestinal stenosis, and will be discussed in detail at another place. Here it may only be emphasized that tumors connected with the small intestine show greater passive mobility than those situated in the large intestine. In carcinoma of the rectum, tenesmus sometimes points to the correct diagnosis.

In Diseases of the Blood.—In conditions which are associated with a persistently bad blood supply of the intestinal tract, constipation is very frequent. Acute anemia of the intestine increases peristalsis, as can be readily shown in animal experiment. But if the inadequate blood supply continues for a longer period the irritability of the intestinal nervous apparatus sinks, and we then find, together with a deteriorated quality of the blood, often quite obstinate constipation, as, for instance, in pernicious anemia, though there are cases of this disease in which profuse diarrhea has been reported.

The constipation of chlorosis deserves some special words. Different authors saw in constipation the cause of chlorosis, assuming that the products of decomposition due to fecal stasis lead to autointoxication. According to this view, various intestinal disinfectants have been recommended for the treatment of chlorosis. It is certainly of advantage to combat the symptoms of intestinal atony which sometimes play an important part in chlorosis, as doubtless it may be a predisposing factor to this disease. But the primary cause of chlorosis probably lies in other conditions still unknown to us. v. Noorden affirms that constipation frequently accompanies chlorosis, being found in about 60 per cent. of all cases but states at the same time that it is by no means a constant symptom. On the other hand, there are very many young girls suffering from constipation who have no trace of chlorosis. Indeed, in young girls constipation is much more frequent than is generally conceded.

v. Noorden speaks against the use of enemas in treating chlorotic constipation; rather he employs mild laxatives, as tamarind, powdered magnesia with rhubarb, or aloes with iron.

Though the intestinal nervous plexus reacts with violent peristalsis to blood poor in oxygen, as may be proved not only experimentally, but also clinically, as asphyxia is sometimes followed at once by diarrhea, we see sluggishness of the bowels in all diseases in which we have to suppose a local venous hyperemia of the intestinal mucosa. But we find in congestive catarrhs at times also diarrheas in which the resorption is remarkably good for a condition with such pronounced catarrhal manifestations.

In Diseases of the Circulatory System.—In acute endocarditis therefore we find constipation very frequently. Diarrhea, if present, is a sign that we have to deal with a severe septic form of the disease (septic diarrhea). Many patients suffering from cirrhosis of the liver and pulmonary diseases, especially substantial emphysema, complain of constipation. In all forms of cardiac weakness (myocardial affections), constipation may arise, and this again reacts unfavorably on the cardiac action. For it leads to more or less pronounced meteorism, hindering in this way the action of the diaphragm, whose normal function is so important for the circulation, especially in its venous part.

In all these cases the bowels must be regulated, but without irritating the intestines, as the resistance of the mucosa is considerably decreased by the congestion.

In Diseases of the Abdominal Organs.—A grave cause of constipation is peritonitis, the circumscribed as well as the general form. In general it may be stated that peritonitis produces rather a picture similar to that of intestinal occlusion than to that of common constipation. But in its commonest circumscribed form, perityphlitis, constipation exists from the onset of the disease, since, with the appearance of the characteristic pain, the bowels cease to move. This may be due to the accumulation of fecal matter in the cecum or to a reflex paralysis of the intestines without the presence of any mechanical obstacle. In some circumstances the compression of another part of the intestines by the perityphlitic tumor or abscess may produce disturbance to passage.

In Gynecological Disease.—Perimetritic exudates and other gynecological affections, as displacements of the uterus, may lead to constipation, though in some of these cases the connection may be the same as that in anal fissure—defecation becomes very painful, and in this way constipation arises from inhibition.

Peritonitis.—General peritonitis is frequently associated with constipation. Its symptom-complex is so characteristic that it is scarcely to be mistaken. The vomiting, the dry tongue, singultus, small frequent pulse changing on any attempt to palpate the abdomen, the accelerated respiration, the expression of severe prostration and of anxiety, the fever, and the intense pain, which scarcely tolerates the weight of the bed-clothes, leave no doubt as to the diagnosis.

In the same way that peritonitis produces intestinal paralysis, it causes more or less of a paresis of the detrusor vesicæ, leading to hindered urinary excretion. On any suspicion of peritonitis cathartics have to be entirely avoided and opium has to be given; for instance, 0.01 to 0.02 gm. of powdered opium, three to four times a day. In acute perityphlitis a normal bowel movement may appear after

this medication, so that it is illogical to dread an exacerbation of constipation from the use of opiates.

In the same way the constipation produced artificially by opiates after operation for hemorrhoids lasting often for eight days and more is tolerated without any bad consequences.

In tubercular peritonitis constipation is rare. Laparotomy has often been advised for its exudative form and has often been performed with good success. Its favorable result lies in the removal of all disorders which the exudate brings with it. Adhesions occur in the further course and the exudate does not recur in favorable cases. According to newer observations, a third of the cases heal even without operation, especially on hygienic, dietetic treatment; this treatment alone has to be considered in the dry and in the multilocular, putrid caseous forms of peritonitis. Inunctions with green soap may be used besides.

In Diseases of the Central Nervous System.—Another important form of constipation associated with violent enteralgia is that found in lead intoxication. Further, many diseases of the central nervous system, especially diseases which lead to increased pressure in the brain, are often associated with a costive condition of the bowels.

Much dreaded is constipation at the onset of meningitis. Especially in children one finds a premonitory sign of meningitis, the children showing beside their changed behavior, only constipation and a slow, slightly irregular pulse. This may last for two weeks until other symptoms arise, as vomiting, and within a few days the typical picture of meningitis develops. In other cases permanent or only temporary recovery may occur after these symptoms have lasted for weeks. Such temporary irritations of the brain are in some cases due, perhaps, to a small dissemination in the meninges. Post-mortem, one has found occasionally in tubercular meningitis distinctly two or more eruptions.

Still, constipation with slight symptoms of cerebral irritation does not necessarily, in every case, demand this fatal diagnosis. An autointoxication from the intestines may produce the same symptoms, disappearing promptly after the administration of calomel. In this way the custom developed of prescribing calomel wherever symptoms of basilar meningitis have developed. This "deviation to the intestine" brings some relief, but of course only transient.

Constipation in *meningitis* is scarcely due to a spasm of the sphincter, but to diminished peristalsis. The abdominal walls of these children are usually so flabby that any peristaltic movements may be plainly observed through them, and one can see how infrequent and slow they are.

Henoch, Barthez and Rilliet associate the constipation and the

navicular abdomen, which is due to a contraction of the circular muscles of the intestines, with stimulation of the inhibitory nerve of the intestines, the splanchnic.

C. NARROWING AND OBSTRUCTION OF THE INTESTINES

General Remarks.—Under intestinal stricture we comprise an incomplete closure of the intestinal passage; under intestinal occlusion, a complete one. Both are very dangerous conditions, and therefore deserve a more detailed discussion.

Independent of the nature of the causes which lead to this symptom-complex, the results of an obstructed intestinal lumen are always the same. The first question we have to answer is if we really have to deal with intestinal obstruction before we are able to answer the other questions as to the nature and localization of the trouble.

Acute and Chronic Disturbances of Passage.—A great difference exists between the acute and chronic intestinal obstruction. Chronic intestinal stenosis should be taken up first, and we must add that it is frequently followed by an acute occlusion. The enormous filling of the intestinal loop above the stenosis and its complete emptiness below are, in chronic intestinal stenosis, not very pronounced. But the intestinal wall itself presents, in its upper part, a peculiar picture. A muscular hypertrophy develops, similar to that of a heart which has to furnish compensation. It may extend quite high above the stenosis, but, of course, is most pronounced immediately above the obstacle. The time which it takes for this hypertrophy to develop markedly is, according to Nothnagel, nine days, but it is recognizable even on the fourth or fifth day.

The pathological changes in the musculature superinduce changes in its function. The hypertrophied musculature does not produce the usual peristaltic wave, but rather a persistent wave, so to speak, a standing wave, which we call intestinal stiffness (darmsteifung). The part of the intestine above the stenosis sometimes resembles a cystic tumor, and only on percussion do we learn that it gives a tympanitic sound. The "darmsteifung" is associated with colicky pains which cease with a gurgling sound when the narrowed part has emptied its contents and the stenosis has been overcome.

The mucosa above the stenosis shows a more or less severe catarrh; ulcerations, stretching, and peritoneal adhesions develop sometimes; also perforation into the free abdominal cavity or into a sacculated space; stercoral abscesses, and sometimes even purulent phlegmon of the abdominal wall.

The rapidity with which these symptoms arise will depend on whether the stenosis is located in the small or in the large intestine.

A moderate stenosis in the small intestine will not cause any considerable obstruction on account of the thin quality of its contents; the same stenosis in the large intestine will produce severe symptoms because the feces are already formed there. In slight stenosis of the small intestine there are sometimes no subjective sensations. The severest form of chronic intestinal stenosis is, on the other hand, much more pronounced in the small intestine than in the large, since the stenosis may lead to complete occlusion at an earlier period by accumulation of the contents.

Quite different are the anatomical findings in acute intestinal occlusion. The part above the stenosis is filled to the maximum, that below completely empty. From the point of the stenosis upward there develops, in the simple obturation of the intestinal lumen, the so-called obstruction meteorism, which progresses gradually upward. But if the blood supply of the intestine is severely injured, as in volvulus or in the formation of loops, a marked local meteorism develops in that part affected by the venous stasis.

Symptomatology of Acute Intestinal Occlusion.—v. Mikulicz, in speaking of the symtomatology of acute ileus, points out that the triad of symptoms as usually given is quite unjustifiable, since all three are present only in the completely developed disease. They are stercoral vomiting, general meteorism, and chronic retention of the feces and flatus.

Stercoral Vomiting.—Stercoral vomiting is never an initial symptom. It will appear sooner or later, according to the localization of the stenosis; in a stenosis at the junction of the duodenum and jejunum it may be completely absent, bile alone being vomited, and it will occur later the farther the stenosis is from the stomach. It would be entirely false to believe that stercoral vomiting can only occur in stenosis situated very low, where the chyme is entirely of fecal character. It is by no means necessary that feculant smelling masses come from those parts of the intestine where the contents have this quality normally. Where stasis of the congesta exists and the bacteria of putrefaction can develop undisturbed, a fecal quality of the chyme is produced where on normal action of the intestine it does not occur.

Meteorism.—Regarding meteorism, it may be stated that it may be absent in strangulation (v. Mikulicz). To exclude ileus, for this reason, would be entirely fatal, for in strangulation an early diagnosis is of greatest importance to save the patient.

Local meteorism, to which v. Wahl and Kahler called attention, is of incomparably greater importance diagnostically than the general meteorism which is due to stasis, since it points to the locus mali. There exists an important means of differentiation between these

two forms. In the meteorism of stasis the inflated intestinal loops show a violent peristalsis; in local meteorism peristalsis can no longer be produced, since the tonus of the intestinal musculature is too severely injured.

The opinion that meteorism goes parallel with the obstruction of the intestines would be entirely false. On incarceration of external hernias, meteorism is often absent, though the passage is absolutely impermeable. Meteorism will always be absent if the absorption of gases by the intestinal vessels can keep pace with their production.

Retention of Feces and Gas.—Retention of feces and gas indeed exists from the onset, but this symptom is certainly insufficient to make the diagnosis of ileus. If, with v. Mikulicz, we define ileus as a completely hindered passage of the intestine, we have in this definition included the paralytic ileus of peritonitis.

The severe manifestations on the part of the nervous system which arise on longer duration of ileus have generally been explained as reflex processes.

In recent times Clairmont and Ranzi have regarded them as produced by the absorption of toxins from the different part of the volvulus.

Forms of Ileus.—Obstruction of the Intestinal Lumen.—If we disregard the obliterations of the intestinal lumen in its higher part, which are of interest only for the pathologist, we have only two forms of congenital intestinal obliteration to consider, the atresia ani and the atresia recti.

In atresia recti the anus may be completely developed, but it does not communicate with the rectum, which has a blind ending farther up. If, in the new-born, the picture of disturbed passage develops, *i.e.*, if the child vomits everything, and meconium and stools have never been passed, we will by digital examination of the rectum feel for obliteration of the intestines. It is rarely possible to produce the communication by operation, and thus there remains only the formation of an artificial anus; but generally these children cannot be kept alive.

Atresia ani gives a better prognosis. The anus may be entirely absent or sometimes be present in the form of a slight dimple; in other cases a fistula, from which some meconium oozes, leads from the anal depression to the heavily filled rectum lying above. If the operator knows where he has to incise, as when a bluish tumor protrudes on pressure in the anal region, the prognosis *quo ad vitam* may be favorable. But even after a successful operation the symptoms of intestinal stenosis may arise; if on the farther course, a cicatricial stenosis develops.

Incarceration of Hernias.—The incarceration of hernia and

its symptomatology is, in fact, the domain of the surgeon. But in every case of ileus it is of the greatest importance to examine carefully all external hernial apertures, and it must be considered as malpractice if this is omitted. In those cases in which a hernia is found to be present and is apparently free we ought to assume that the disorders of the intestinal passage are indirectly caused by this hernia until we have proved that the ileus has been produced by another disease. Experience teaches us that though no pathological signs are to be found in the hernia, a kinking or strangulation from peritoneal adhesions may produce symptoms of ileus proximal to the hernial aperture. Typical for many incarcerations is the localization of pain in the region of the umbilicus.

Regarding the attempt at reducing the hernia, Hagen advises not to try this more than three times, each time giving atropin an hour before. In this way as well as by the application of an ether spray to the abdominal walls the taxis is said to become easier. If the reposition has apparently succeeded, but symptoms of ileus persist, we must think of a pseudoreduction or of intestinal paralysis. The first case is more favorable since surgical intervention may even then give relief, whereas we are almost helpless if we have to deal with intestinal paralysis.

Internal Incarceration.—Incarceration within the abdominal cavity develops under the same clinical manifestations as external incarceration. In both cases the patients complain of a sudden violent pain, localized especially in the umbilical region. Vomiting is almost always present, followed by symptoms of absolute obstruction; that is, neither gas nor feces pass. This is the more remarkable since internal incarceration attacks the ileum in most cases, and, therefore, feces could still be evacuated from the filled colon. Only the presence of intestinal paralysis can explain this immediate onset of the obstruction. Incarceration differs from volvulus, and especially from intussusception, by the absence of bloody mucoid passages from the intestines.

This morbid condition just described allows an exact diagnosis only in the rarest cases. Somewhat easier is the diagnosis of diaphragmatic hernia, though of this only 2 per cent. of all cases have been diagnosed, according to Leichtenstern. The picture in these cases is sometimes similar to pneumothorax. One side of the thorax is dilated and gives the phenomenon of auscultatory percussion. Of the other intestinal incarcerations, that into the bursa omentalis and the hernia duodenojejunalis must be mentioned (Treitz). Here belongs the mesenteric incarceration of the intestine (Schnitzler); the mesentery of the small intestine compresses the duodenum, the pedicle of the mesentery placing itself before the duodenum in very

greatly filled jejunal loops. In this way acute occlusion is produced without strangulation. No meteorism develops, only inflation of the stomach; a pure bilious vomiting occurs usually without feculent odor.

Strangulation.—Strangulation of the intestine is produced by pseudoligaments when the intestine becomes adherent to inflamed, neighboring organs, as the right flexure of the colon in pericholecystitis and the left flexure of the colon in perisplenitis, and by persistent embryonic formations which have not undergone involution. Meckel's diverticulum may sometimes give rise to strangulation if it is connected with the umbilicus by a terminal ligament.

A case is related in the literature where Meckel's diverticulum filled with ascarides has caused strangulation.

Volvulus.—Volvulus has been described and analyzed by Rokitansky in a way which is still valid to-day. He distinguishes three forms of volvulus:

1. A part of the intestine twists about its longitudinal axis.
2. About its mesentery as a longitudinal axis.
3. A part of the intestine with its mesentery furnishes an axis about which another loop with its mesentery is twisted.

Volvulus occurs most frequently in the sigmoid flexure. It is usually found only in persons of advanced age, who for a long period have suffered from constipation; it develops suddenly; only in rare cases gradually. Sometimes peritonitis of the mesentery, in other cases a congenital abnormal disposition of it, is the predisposing cause. Netter believes that we have to deal with those anomalies that play the part of etiological factor in Hirschspring's disease. The sigmoid flexure is readily inclined to volvulus if the base of its mesentery is short but the mesentery itself very long. Occasionally an intestinal noose may be formed between the sigmoid flexure and the small intestine.

Volvulus is characterized by the appearance of violent pain, sometimes by the passage of blood even in volvulus of the small intestine (Naunyn), by local meteorism, consisting in the "fixed, inflated immobile loop" which, in volvulus of the sigmoid, extends from the left iliac fossa across the abdomen up to the liver. Vomiting sometimes gives relief in volvulus, in distinction to the other forms of strangulation. In volvulus of the sigmoid also tenesmus is sometimes observed.

Only after several days do severe symptoms appear; indeed, stercoral vomiting may not appear for a week. The treatment consists in surgical intervention which becomes necessary in almost all cases. We should not be satisfied by disentangling the volvulus, since it tends to recur, but should prevent such a recurrence by fixation of the loop.

Tschernow has recently reported on the volvulus of children. The sigmoid volvulus is very rare under fifteen years of age, whereas other forms of strangulation, as obturation of foreign bodies and tumors, the constriction by scars and peritoneal adhesions, but chiefly invagination, are at least as frequent in children as in adults.

The volvulus of the cecum is only possible with a mobile cecum, *i.e.*, if there is a common mesentery for ileum and cecum; apart from this, the ascending colon must be freely mobile to some degree. Twisting of the intestine about its longitudinal axis, as well as round its mesentery, has been described. The first produces the picture of simple obturation, the latter that of strangulation, since the vessels extending into the intestine are compressed at the same time. The latter form, producing more severe symptoms, therefore comes to the surgeon earlier for operation and so gives better results. On suddenly occurring abdominal pain, vomiting and constipation, and on appearance of local meteorism without peristalsis, one will always have to think of cecal volvulus. The absence of fever will be of value in differentiating it from perityphlitis.

Invagination (*Intussusception*).—Occasionally at postmortem one finds an intestinal invagination which has produced no symptoms during life. It is then an agonal condition which is not of much importance. The invagination may occur in the descending direction as well as in the ascending, *i.e.*, the higher part of the intestine may shove down into the lower part or *vice versa*. Most invaginations, however, developing *intra vitam* are descending ones.

Two explanations for invaginations exist, and, correspondingly, one distinguishes a spasmodic and a paralytic invagination. In the first case it is supposed that the spasm of one part of the intestine is the immediate cause of the invagination, the spastic part becoming the intussusceptum, whereas in the other form the paralysis of a part which represents the intussuscipiens is said to be the primary factor in the invagination. According to the localization we distinguish four forms:

1. The iliac, in which a part of the small intestine slips into another part.

2. The ileocecal, where the ileocecal valve forms the point of entrance for the intussusceptum.

3. The ileocolic, in which the higher part of the ileum slips through the valve into the colon.

4. Colic, whereby one part of the large intestine slips into another part of it.

A long mesentery of course favors the production of invagination. It is remarkable that, in children, it is not usually the weak ones, but rather the robust, thriving, breast-fed children who suffer from invagi-

nation. It is found most commonly in the first two years of life. At a later age trauma, the puerperium, and intestinal tumors are the chief pathogenetic factors. Not the malignant tumors, but usually intestinal polyps have to be considered in this connection, for in the first the intestinal wall is strongly infiltrated, hindering invagination in this way (Duchossoy).

Clinically, the picture is characterized by sudden pain and by vomiting, which is constant in children, but not in adults. Owing to the violent pain, infants may suffer from convulsions. Tormenting tenesmus occurs paroxysmally, whereas the pain, a true colic, persists from the spasm of the intestines. Several authors report that the anal orifice stands open, owing to anal spasm. A spontaneous reduction of the invagination occurs sometimes, namely, in those cases in which the process has not progressed very far, and where the peritoneum of both parts has not become adherent. Once this adhesion has taken place, recovery is still possible, but in another way. The invaginated part becomes necrotic from its disturbed circulation, the peritoneal layers coalesce with each other, and the intussusceptum is expelled. The passage of very long portions of the intestine has been reported, and the author once observed the expulsion of a piece 17 cm. long, with complete recovery. In a second case, similar to this, which also ended in recovery, a second intussusception occurred several months later, and was healed by surgical intervention. This healing may of course be incomplete, since, at the point of union of the two peritoneal layers, a chronic stenosis may develop.

For the diagnosis of intussusception there are two chief factors: First, the presence of a tumor which is usually found in the ileocecal region, in the form of a sickle, with its convexity directed outward; second, the passage of frequent, small, bloody, mucoid stools. In the ileocolic intussusception the high degree of mobility of the tumor is remarkable.

The treatment of intussusception will aim to replace the invagination by pressure in the rectum if the process has not existed for too long a period. High enemas under great pressure and with a great quantity of water, elevation of the pelvis, and administration of anesthetics, with their tendency to relax the abdominal walls, are appropriate measures. Heubner and others recommend the insufflation of air, using a T-tube; the vertical part of it is introduced into the rectum, one end of the horizontal portion is connected with a balloon and the other with a pinchcock, to allow the air to escape when the inflation has reached its maximum. This safety valve is necessary to avoid the danger of rupture of the intestines. Besides, it is advisable to

give opium to quiet peristalsis even after a happy solution of the invagination, as there is always danger of a relapse.

Of great interest is the rarely occurring chronic intussusception, as described by Treves and Rafinesque; the sausage-shaped tumor is present as in the acute form, the manifestations, however, are much less violent. Rafinesque collected forty-six cases of chronic invagination; seven of them had normal stools, sixteen diarrhea, twelve constipation, and eleven were of varying behavior. Cathartics are sometimes useful in the chronic invagination.

If all measures above described are ineffectual, surgical intervention becomes necessary and may accomplish recovery, but it must not be delayed too long, especially in the acute form, since severe collapse often occurs very rapidly, rendering the success of the surgeon questionable.

Compression of the Intestine.—Obturation of the intestinal lumen by compression is most readily produced by the presence of tumors in the lower portions of the intestines, since there the resistance of the bony structure renders the pressure of the growing tumors more effectual. In uterine and ovarian tumors, and in pelvoperitonitis, symptoms of intestinal compression are sometimes found. But also the small intestine, even the duodenum may be compressed, the latter very easily by tumors of the pancreas. The diagnosis of these tumors may become especially difficult if an accumulation of feces above the point of compression has already developed. The attempt to cleanse the intestine by laxatives and intestinal lavage does not always result in the immediate and complete evacuation of the bowel, and, as Nothnagel says, even experienced physicians may be in a severe diagnostic dilemma, the more as the intestinal loops, filled with feces, become through peritoneal irritation so sensitive to pressure that an exact examination is scarcely possible.

Obstruction of the Intestine.—Compression of the intestine is clinically very similar to obturation of the intestinal lumen by its contents, or by formations in its wall. Obturation may be associated with any other form of disturbance of the intestinal passage, since the accumulation of feces above the stenosis furnishes a farther hindrance to the passage.

We have first to speak of obstruction by stercoral tumors due to accumulated and inspissated feces, chiefly found in the ampulla recti. Such stercoral obstruction may be present even if the anamnesis reports regular daily stools. We have to deal here with small quantities of feces which remain unpassed every day which agglutinate, in this way, into tumors. An accumulation of feces should never be considered the exclusive cause of ileus; that is, only after all other factors have been excluded should one think of stercoral tumor. For this is

the only case of ileus in which we may use laxatives, though evacuation is sometimes better brought about by soap enemas or by introduction of the finger or a special instrument into the ampulla of the rectum.

Coproliths, also, must be mentioned. They develop from long stagnating, inspissated stools, which are impregnated with salts as magnesium or calcium carbonate, owing to their long medicinal use; in mentally disturbed patients and in the hysterical, eating of mortar from the walls or of chalk may play the same part. The manifestations of ileus in these cases are generally preceded for some time by loss of appetite. Here also belong foreign bodies (cherry stones) of the intestines, to which our attention is usually called by the anamnesis.

Gall-stones have sometimes led to ileus (Heinrich Haller). They have then probably not been expelled into the intestines by the hepatic duct, but by a fistula between the gall-bladder and intestine. The conception that only large stones can lead to ileus is false. The stone irritates the intestine, leading to its contraction, and in this way may produce ileus, though its actual size may be insufficient to fill out the intestinal lumen. Even the form of the stone plays a certain rôle, longitudinal stones passing somewhat more easily than spherical ones. On incarceration of the stone, constipation, meteorism, fecal vomiting, and collapse are the chief symptoms.

Naunyn has called attention to the fact that flatus may pass occasionally. Obturation of the small intestine is much more frequent in its lower portion, for its lumen becomes progressively smaller toward the ileocecal valve. Further, obturation may be produced by a mass of ascarides balled together into a tumor, and by tumors proper; especially by carcinoma with its well-known tendency to annular form.

Carcinoma.—Carcinoma of the large intestine usually causes painless constipation for a long period, indeed it is just in this condition that the most stubborn constipation is found. Thus a case is related where the retention lasted eighty-eight days. In these cases even chronic ileus may develop, with the horrible symptom that the patient for months has no passage, but empties all food taken in as feces by the mouth.

In the stools we find mostly pus and blood; pus in larger quantities when the tumor is extensive and exulcera'ed, whereas the passage of blood may be observed at a very early stage, coming from the rhagades produced at the point of stenosis by the pressure of the feces.

Nothnagel states that the passage of blood mixed with mucus and pus points, in fact, only to two conditions, carcinoma and dysentery.

In diagnosing the localization of the tumor we have to determine the extent of both active and passive mobility. The largest excursions are found of course among those cancers of the large intestine which are localized in the transverse colon or in the sigmoid flexure. But also at other localizations they sometimes show considerable mobility, even if not to the extent of tumors of the small intestine.

It is sometimes difficult to differentiate a stercoral tumor from a neoplasm, and v. Leube considers also the chronic sigmoiditis as a possible differential diagnostic error in carcinoma of the sigmoid.

In carcinoma of the rectum pain and hemorrhoids are early symptoms. This fact makes it all-important that the digital examination of the rectum should never be omitted when the patient's complaint is of hemorrhoids.

Cicatricial Strictures.—In regard to ileus produced by cicatricial stricture, the opinions as to what kinds of ulcerative processes may lead to constricting scars have greatly changed in recent times. Tubercular and stercoral ulcers lead in this regard; much more rarely duodenal, dysentery and catarrhal follicular ulcers, and almost never typhoid. In earlier times it was believed that dysentery especially left constricting cicatrices, an opinion which has been refuted by Woodward. Leichtenstern believed that it was a constricting peritonitis which in the course of intestinal tuberculosis led to intestinal stenosis, whereas König proved that we have to deal with true cicatricial stricture.

Why typhoid ulcers on cicatrization do not lead to stenosis is not entirely clear. It was explained by their small size and by their position parallel to the longitudinal axis of the lumen. But one finds sometimes in severe typhoid very extensive ulcerations.

A rare form of stricture is that following a spontaneous expulsion of an invaginated portion of the intestines. Strictures of the rectum are very frequent, especially in women. The cicatrization follows traumatic ulceration caused by injury with enema points or exulceration of hemorrhoids, luetic, dysenteric, rarely tubercular and stercoral ulcerations.

Annular, circumscribed peritonitis with adhesions may also lead to constriction of the intestinal lumen from without.

Paralytic Ileus.—The paralytic form of ileus is often clinically entirely similar to strangulation, and may be primary, or secondary following other severe symptoms. It is primary by reflex processes (paralysie par reflexe, of the French).

Gall-stone Colic.—Thus, gall-stone colic may produce the complete picture of ileus, though the stone never reaches the intestine nor there produces obturation; this ileus disappears at once as soon as the stone has passed the ductus choledochus. The whole intestine

may be paralyzed if the stone has in fact reached the intestinal lumen, but has become incarcerated high up, as in the upper part of the jejunum.

Kidney-stone Colic.—Nephrolithiasis may occasionally simulate ileus. The differential diagnosis of these diseases will be given at another place. An incarcerated movable kidney, an incarcerated testicle retained in the inguinal canal, or an incarcerated appendix or portion of the omentum, or Meckel's diverticulum may, too, be mistaken for ileus.

Ovarian Cyst; Twisting of the Pedicle.—Twisting of the pedicle of an ovarian cyst leads to symptoms of intestinal occlusion, as does Littré's hernia in which only a part of the intestine is incarcerated, so that one cannot speak of intestinal obstruction.

The prognosis of all these forms of ileus is quite favorable if the inciting cause can be removed. Thus a normal intestinal passage may be regained after the inflammatory symptoms of the inguinal testicle have disappeared.

Postoperative Ileus.—Very dangerous owing to our helplessness is the ileus following laparotomy, which is due to the mechanical offense to the intestine. A hindered function of the abdominal musculature, as after suprapubic cystotomy when the recti muscles have been cut through, may cause still another form of ileus.

Peritonitis.—Paralytic ileus is found in local and general peritonitis; sometimes it is associated with perityphlitis, different factors concurring in its production.

We may have to deal with an intestinal paralysis, with mechanical obstruction of its lumen, or with adhesions which bring about kinking of the intestine.

Since intestinal paralysis is a very frequent consequence of peritonitis and, on the other hand, peritonitis may in some cases follow ileus, it is of great importance to decide which condition is the primary one. To determine this question the following table prepared by Graser may be useful:

PERITONITIS	ILEUS
Usually rapid rise of temperature, only rarely collapse temperature.	Beginning without fever—often subnormal. Later gradual increase, especially on complications.
Patient behaves entirely quietly. Abdomen very sensitive to pressure, even to the slightest touch.	Patient gives the picture of jactitation—may even try to get up; abdomen not tender to pressure and pressure sometimes allays the pain.
Spontaneous pain, becoming gradually less.	Spontaneous pain increasing in intensity. Attacks more frequent and severe.

PERITONITIS	ILEUS
Stercoral vomiting rare, appearing late.	Stercoral vomiting early.
Meteorism diffuse from the beginning.	Meteorism at first local, later more extensive.
Intestinal loops not visible nor palpable.	Intestinal loops visible and palpable like isolated strings.
No peristalsis.	Often marked peristalsis.
Abdomen hard, of board-like tension.	Abdomen at first soft, no tension.
Abundant exudate in abdominal cavity.	No, or only little, exudate.
Sometimes passage of gas.	Complete obstruction.
Frequent singultus.	Singultus rare.

Thrombosis and Embolism of Intestinal Vessels.—Another form of secondary ileus is that sequent to thrombosis and embolism of the intestinal vessels, followed by peritonitis and gangrene. The symptoms are exactly the same as in strangulation; violent pain, vomiting, occasional bloody stools, and collapse compose the picture of the disease, of which we will think especially if the patient has endocarditis.

Intoxications; Nervous Diseases.—The spastic form of ileus is sometimes found in lead and mercury intoxications; the adynamic form (Murphy) after lesion of the spinal cord and in the course of uremia.

Hysterical persons may sometimes present the symptom-complex of ileus. However, the undisturbed general condition will render the diagnosis possible, though we must not forget that sometimes an hysterical individual may suffer from a true ileus.

Special Symptomatology of Ileus.—In the previous pages we have spoken of symptoms which are common to all forms of ileus as they are found in the developed disease. We shall now analyze the initial symptoms, which are of special importance as the life of the patient in most cases depends on an early diagnosis.

Very important, and sometimes pointing to the existence of ileus, is the sudden appearance of a violent pain. It is severest in strangulation, less severe in obturation and paralytic ileus. In opposition to gall-stone and renal colic, it is remarkable that pressure does not augment the pain in ileus, an important symptom for the diagnosis. v. Mikulicz emphasizes that violent shock occurs at the same time and that great value must be placed on the initial vomiting; it appears once or twice and then ceases, to return again later after stasis, whereby it may change its character and become feculent.

In regard to the exudate we must distinguish between the exudate of diffuse peritonitis and the serous fluid of the hernial sac which has been freed into the abdominal cavity; this latter condition is of itself

no *signum mali ominis*. Occasionally exudate has been mistaken for intestinal contents, namely, on puncture of a filled intestinal loop, whose watery contents have exuded. Since the filled intestinal loops may even cause a change of sound on changed position, it furnishes yet another opportunity of mistaking ileus for diffuse peritonitis.

The temperature is variable and therefore gives no diagnostic help. The pulse is usually more frequent and smaller in strangulation than in simple obturation, and, if peritonitis appears, assumes the quality characteristic for this disease.

Diagnosis of the Location of Obstruction.—For the localization of the hindrance to the intestinal passage the following considerations are helpful:

Purely bilious vomiting, absence of feculent vomiting and of meteorism, with the presence of marked inflation of the stomach, characterizes an obstruction situated high up, as at the juncture of the duodenum and jejunum.

The indication by the patient of the point of pain is not reliable and we cannot therefore make much use of it for the topical diagnosis. Of great diagnostic importance is the sequence of symptoms. If violent vomiting follows soon after the initial pain, it will speak for stenosis of the small intestine, as will also a rapidly following pronounced collapse, since the mesenteric plexus is more strongly developed in the small than in the large intestine.

Fecal vomiting does not speak for stenosis of the large intestine, as might be expected in advance, but if it appears very early it speaks for stenosis of the small intestine. We have previously pointed out that volvulus of the sigmoid may persist a week before stercoral vomiting develops, whereas in occlusion of the jejunum pronounced fecal vomiting may appear as early as the second day.

It is of further importance whether the meteorism decreases rapidly after vomiting. In general this would speak for a high seat of the stenosis. The form of the meteorism also may to a certain degree serve to decide the question of location. Meteorism in the flanks is found if the large intestine is inflated, though a severe inflation of the jejunum may simulate this. Whether loops of the large or of the small intestines are inflated may be decided from the peristalsis, if we do not have to deal with the fixed loops of local meteorism. The peristalsis of the small intestine runs in very rapid waves, whereas peristalsis of the large intestine is incomparably more sluggish.

An opinion as to the localization of the stenosis may be gained to some extent by the more or less changed condition of the blood passed per anum. Further, by observations gained by giving injections. First we have to notice how much water can be let in, and we

must remember that the rectal ampulla may hold about 1 liter of water, so that only very deep-seated stenoses render the injection of greater quantities of liquid impossible. A more important point is the amount of stool which may be removed in this way. By percussion we will try to find out how far up the intestine has been filled with water, and Treves has advised to auscultate the ileo-cecal region during the injections to discover by the sound if the water had reached this point.

It has long been known that the indican in the urine is greatly increased in stenosis. This indicanuria appears earlier and more abundantly in stenosis of the small intestine, whereas in that of the large intestine it can be demonstrated only after a longer period and in small amounts. In stenosis of the ileo-jejunum, oliguria is usually found earlier than in that of the large intestine, and this may have some connection with the previously mentioned greater tendency to collapse.

Treatment of Ileus.—We first have to examine all hernial apertures, to palpate per rectum and per vaginam, in order to exclude incarceration. If this can be excluded, we will for the time abstain from surgical intervention, until we have obtained a more accurate idea of the nature of the condition by careful observation of the patient. During this period of observation which should not be obscured by too large doses of opium, our first principle must be *primum non nocere.* It is to be emphasized that in most cases cathartics may be injurious, and are indicated only in obturation from stercoral tumors, whose diagnosis is only possible *per exclusionem.* Therefore, in doubtful cases, irrigations will be preferred to cathartics. The pain of the patient may be allayed, in so far as the diagnosis is not disturbed, by opiates and morphin. We have no right to withhold this relief from the patient. From different sides it has been emphasized that by this means the patient is deceived as to the gravity of his condition, and that he will therefore refuse permission for the operation which will be necessary eventually. Naunyn rightly responds that it is not our business to torment the patient in order to make him more tractable.

Atropin has gained more and more adherents in recent times. Theden, in 1788, recommended belladonna preparations for ileus, and lately sulphate of atropin has been used quite boldly, even exceeding the maximal doses, and in some cases with excellent results. According to Pal, atropin is of advantage only in the dynamic and paralytic ileus, not in the mechanical form. Ripperger advises the avoidance of atropin also in strangulation and incarceration. Moritz gives extract of belladonna in large doses every hour and has seen good results from it in ileus as well as in perityphlitis.

As far as the diet is concerned, all physicians agree that complete abstinence from food is the only right thing in a true ileus. Nevertheless if some food must be given, wine, beef tea, or milk may be taken in tablespoonful doses. In general, for the tormenting thirst one will give thirst enemas or subcutaneous infusions of physiological salt solutions, which Curschmann warmly recommends.

Of the other measures taken to remove intestinal occlusion, lavage of the stomach deserves our consideration. By repeating this procedure several times a day not only is the subjective discomfort of the patient greatly relieved but the tormenting vomiting may cease for at least a few hours; we certainly accomplish something in directly removing the intestinal occlusion. A short time after the lavage, the stomach again becomes filled with ingesta streaming back from the intestines. We can, therefore, by repeated lavage, unload the intestines as far as the point of occlusion, and thereby certainly help to remove strangulation with kinking.

Intestinal lavage also is advisable; only we must not think that high pressure and large quantities of liquid are the most useful factors; on the contrary, the liquid will penetrate much higher if it is allowed to flow in gradually under small pressure.

Nothnagel has proved by animal experiment that enemas of 5 to 8 per cent. salt solution may remove invagination, and therefore we will occasionally make use of this method. Water containing CO_2 may also be used, taking it from a siphon or producing the CO_2 within the rectum by mixing a carbonic acid salt with a dilute acid.

Treatment by insufflation of air has been taken up under the Treatment of Invagination.

In rare cases of volvulus the following mechanical procedure may have some success. The patient is placed in knee-elbow position, his abdomen is supported by the physician's left hand, while the right, clenched, beats the sacral region with rather forcible strokes. The concussion of the intestine may occasionally lead to the reduction of the volvulus, but this is a chance on which we cannot count. The question whether we should operate is not easily answered, the more since an exact diagnosis is generally not to be made, or at least not very soon. Theoretically, volvulus, kinking, and internal incarceration should be operated as soon as possible, though the diagnosis is not easy, nor is the decision as to the proper point of incision. In simple obturation some time may be spent in the above-mentioned measures, though one should not wait so long that collapse renders surgical intervention of questionable value.

When we operate we have usually to deal with an intestine already severely injured, and primary resection therefore gives no desirable result as the sutures do not hold. v. Mikulicz therefore prefers entero-

anastomosis or the formation of an artificial anus to remove the immediate danger to life. Closure of the artificial anus and resection may be performed later.

We have still to mention one measure which we speak of after operation since occasionally it has been combined with it. This is the puncture of the intestine which Curschmann performs by means of a Pravaz syringe, to free the excessively inflated intestine of its gaseous contents. As paresis of the intestinal musculature is usually marked, the intestinal contents may ooze out through the opening made by the cannula and produce peritonitis. Naunyn and Graser therefore object to this procedure. After the abdomen is opened, it may in some cases be of good service, since the inflated intestine which pushes against the incision is made to collapse in this way; there is no difficulty in replacing the intestinal loops; one gains in this way a better orientation, and can more easily remove the obstruction.

D. JAUNDICE

Definition.—By jaundice we understand a yellow discoloration of the skin and mucous membranes. This is an associated phenomenon in very different morbid conditions, in some of which it is the most pronounced symptom, a fact which then finds its expression in the name of the disease; *e.g.*, icterus catarrhalis.

Though jaundice in itself is not to be considered dangerous in most cases, it appears sometimes under conditions which give great weight to its presence. The yellow discolorations which we comprise under the name jaundice are in most cases produced by biliary pigments.

Hepatogenous and Hematogenous Jaundice.—Whereas in earlier times they tried to distinguish the hepatogenous and hematogenous forms, we know to-day that even in those cases in which not bilirubin, but urobilin (urobilin icterus) is found in the urine, the yellow color of the skin is brought about by the deposition of bilirubin in the connective tissue. Therefore this case must also be added to the hepatogenous form of icterus. The term hematogenous jaundice may, perhaps, be reserved for those cases in which jaundice develops from extensive internal hemorrhage.

Diagnosis of Jaundice.—The diagnosis of jaundice is usually not difficult. Only when the yellow discoloration of the skin is very indistinct doubt may arise; the more since there are individuals who constantly show a yellowish tint of the conjunctiva scleræ, which is the first symptom used in making the diagnosis. This is something difficult to recognize by artificial light, but the diagnosis may be

rendered easier by holding a sheet of white paper near the eye, which produces a strong contrast with the yellow discoloration. In higher degrees of jaundice the stools are usually grayish-white and of an asbestos luster; the urine is dark, containing bile-coloring matters; the general integuments and visible mucous membranes of yellowish color. In special cases the skin assumes a dark, dirty brown color (icterus melas); the mucous membranes are then of an intense yellow color, which symptom appears especially marked when they have been rendered bloodless by pressure.

Theories of the Origin of Jaundice.—Icterus may be caused by a hindrance in the bile duct which prevents the outflow, until the increased pressure of the secreted bile overcomes the blood pressure in the portal system. By obstruction of the bile duct, certain constituents of the bile, pigment as well as biliary acids, pass into the blood. All authors who have occupied themselves with the explanation of jaundice have long recognized that not all forms can be explained in a mechanical way, because, at postmortem hindrances could not always be found of such a nature as to explain the origin of jaundice by obstruction to the duct. Some, as for instance Harley, believed that jaundice might develop from suppressed secretion of bile, due to a diseased condition within the liver, the constituents of the bile, not being excreted, accumulating in the blood and discoloring the skin. Numerous other theories have been proposed to explain the pathogenesis of jaundice.

Mechanical Jaundice; Acathectic Jaundice of Liebermeister.—The occurrence of an exceedingly abundant biliary secretion, produced by the working over of the decomposition products of the blood in the liver, has, too, been considered as the cause of jaundice (Kunkel). This great quantity of bile poured into the intestine is again resorbed, according to Frerich's opinion, but cannot be worked up by the organism. Stadelmann supposed an increased consistency (viscosity) of the bile to be the hindrance to its discharge, and blamed this condition for the causation of jaundice. According to Liebermeister, some forms of jaundice may be explained by the fact that the liver cells, which under normal conditions have the faculty of preventing the passage of the bile produced by them into the blood and lymph, have lost this faculty in the same way that injured renal epithelial cells have lost their function of retaining the albumin of the blood serum. Liebermeister called this form acathectic jaundice, which, according to him, may be produced by the following conditions:

1. Intoxications with phosphorus, arsenic, mineral acids, alcohol, chloroform, and by the bites of poisonous snakes.

2. Epidemic diseases, as yellow fever, acute yellow atrophy of the liver. In the same way icterus probably also develops in:

3. Pneumonia, malaria, pyemia, typhoid fever, and recurrent fever.

4. Probably, too, in the icterus following psychical emotions.

Paracholia of Ernst Pick.—An interesting conception regarding the pathogenesis of jaundice has been communicated by Ernst Pick, as well as by Minkowski. The first-mentioned author sees in the changed direction of the current of liver secretions the cause of jaundice in nervous, toxic, and infectious diseases. The pathologically changed liver cells, according to his conception, are no longer able to give up their secretion to the bile capillaries alone, but will secrete it in all directions, so that it passes not only into the bile ducts, but also into the lymph spaces which surround the liver cells. He chose the term paracholia for this pathological process.

Against this doctrine of the disturbed function of the liver cells in this general sense Gerhardt and Eppinger have raised serious objections. Minkowski holds the opinion that we have to suppose an icterus by parapedesis, as well as an icterus from stasis. Icterus by parapedesis, according to his opinion, too, develops from a faulty direction of the flow of bile, which is caused by the disturbed functions of the liver cells.

Insufficiency of the Liver Cells.—Repeated postmortem findings by Kretz and others have proved undoubtedly that jaundice can develop without mechanical hindrance to the discharge of the bile, so that the conception that insufficiency of the liver cells may cause jaundice is entirely justified. This disturbed function may be produced by poisons introduced from without, arseniuretted hydrogen, phosphorus, and lead, by intoxicating matters which, having originated in the intestines, are brought in abundant quantities to the liver with the portal blood, or by bacteria and their metabolic products.

Urine in Jaundice.—In the urine of jaundice biliary pigments and acids can usually be detected. Sometimes it contains yellowish-tinged renal epithelia, the latter from the deferent urinary passages; frequently, too, as Nothnagel first observed, yellowish-colored hyaline casts containing a few yellow granules.

Other Secretions.—The sweat and the milk are also sometimes of a yellowish color if the icterus is very intense. If jaundice exists some time in the mother before delivery, the child will also be of a yellowish tinge. The tears, saliva, mucus, and catarrhal sputum are free from bile pigments, whereas in pneumonia the sputum may show a grass-green color due to its biliverdin content.

Feces.—The stool is of a grayish-white color on complete biliary occlusion, and shows sometimes a peculiar soapy luster. It is usually voluminous, hard, and frequently of a foul odor. The peculiar color

of the acholic stool is caused by the greatly increased fat content and not, perhaps, exclusively by the absence of biliary pigments, for if the fat is removed the stool assumes a brownish-yellow color.

Clinical Symptoms.—The clinical symptoms are conditioned by the action of the bile acids in the blood.

Nervous Symptoms.—Of nervous symptoms, headache, vertigo, sometimes depression, in severe cases apathy, somnolence and coma, or maniacal attacks with furibund delirium may be named. A. Pick observed a case of progressive paralysis which immediately followed a catarrhal icterus. One cannot exclude the possibility that in such cases the bile acids, as the inciting factor, have accelerated the appearance of the disease in the same way that other poisons further the appearance of psychopathic symptoms in an existing disposition.

The xanthopsia sometimes complained of is probably not due to a yellow discoloration of the humor aqueous, but may be caused by psychical processes.

Itching.—A very disagreeable symptom, hard to combat, is the pruritis, so frequent in icterus. Since this is probably due to the deposition of bile constituents in the endings of the cutaneous nerves, it is easily understood that the use of external remedies promises only little success in its treatment.

Bradycardia.—A noteworthy fact is the retardation of the cardiac action. A fall of the pulse frequency of twenty to thirty beats per minute below the normal is often observed. This bradycardia, caused by the bile acids, is not, as a rule, observed in small children, which may be explained by the low tonus of the inhibitory nerves of the child's heart. Only at the time of puberty does bradycardia begin to be observed in icterus.

Pain in the liver is a symptom independent of the jaundice, and is caused by the primary disease.

Effect on the Intestines.—Whereas digestion in the stomach shows, as a rule, no deviation from the normal if no catarrh is present, the intestinal digestion shows manifold disturbances. Above all, the fat resorption suffers. The occurrence of constipation deserves mention. It is caused by the absence of the motor stimulus of the bile, and by a paralyzing effect which the bile acids in the blood exert on the unstriated muscle, as well as on the striated.

Latent Period of Jaundice.—If the common bile duct is ligated, it takes three to four days before jaundice appears, whereas in gallstone colic it may be very marked even after a few hours. Cases are recorded of the almost instantaneous appearance of jaundice after emotions.

Sidney Ringer has reported the case of a boy who became jaundiced

in the cold, but lost the yellow color again when he became warm (cited from Ewald).

Schedule of the Forms of Jaundice.—Ewald gives the following table (in Eulenburg's "Realenzyklopädie"):

A. Hepatogenous Jaundice.—(*a*) Hindrances to the flow of the bile in the course of the bile passages and within them.

1. Catarrh of the bile duct.
2. Ulceration of the mucosa and consequent cicatricial stenosis.
3. Impaction of foreign bodies (gall-stones, parasites).
4. Congenital defects of the bile ducts.

(*b*) Narrowing or occlusion of the bile ducts from external pressure.

5. Neoplasms and tumors, located within and without the liver. (In the liver: carcinomatous, sarcomatous, tubercular, syphilitic, and other tumors, and hydatid cysts; outside the liver: tumors and scar tissue, which compress the bile ducts or grow into them, as from the intestines, swollen lymph glands of Glisson's capsule, aneurysm, accumulation of feces in the transverse colon, pressure of the pregnant uterus.)
6. Changes in the liver tissue itself (abscess, interstitial cirrhosis, fat liver, acute yellow atrophy).
7. Hyperemia of the hepatic vessels with pressure on the bile capillaries (nutmeg liver).

(*c*) Falling of the pressure in the hepatic blood-vessels below that in the bile ducts.

8. Heart diseases, blood-vessel diseases, neuroses.

B. Acathectic Icterus; Paracholia of E. Pick.—9. Mental emotions, neuroses, icterus neonatorum.

10. Intoxications with poisons and with food.
11. Traumatic extravasation of blood.
12. Infections, typhoid and recurrent fevers, intermittent fever, erysipelas, pneumonia, pyemia, puerperal fever.
13. Menstruation and pregnancy.

Catarrhal Jaundice.—The most common form of jaundice is catarrhal jaundice. Whereas until recently its origin was always connected with a gastroduodenal catarrh, it now seems, after the investigations of Minkowski, E. Pick, and others, no longer doubtful that the occurrence of this icterus may lie in other causes too, though gastrointestinal symptoms may sometimes precede an outbreak of jaundice and persist during the whole period of the disease. Loss of appetite, nausea, vomiting, headache, and prostration are the most pronounced subjective symptoms. Associated with them is usually a rapid emaciation, which is due to the anorexia as well as to the toxic decomposition of proteids, which has to be considered even in

simple icterus, if it lasts for some time (R. Schmidt). By food rich in proteins Fr. Müller succeeded in preventing the loss of proteids.

Beside the above-mentioned manifestations, a catarrh of the small intestine is usually present. The pathogenesis of catarrhal jaundice was generally conceived as a catarrh of the duodenum, which, extending to the common bile duct, caused swelling of its mucosa and produced by this inflammation and the accumulated masses of mucus, biliary engorgement.

Stoos refutes this pathogenesis for the common icterus of childhood for the reason that one seldom sees in children symptoms of indigestion associated with the icterus, and that, even in enteritis which leads to duodenal ulcers, and in gastrointestinal catarrhs of infants, jaundice is never observed. He considers the so-called catarrhal jaundice of children as an infectious disease, an opinion which certainly seems also plausible for some forms of jaundice in adults. These cases are more similar to an abdominal typhoid than to an acute gastritis. At the onset of such cases one usually finds the general symptoms of a beginning severe infectious disease, remittent fever which lasts at times even for weeks, and an enlarged spleen which makes the picture still more similar to typhoid.

The duration and intensity of the different symptoms show a varying behavior in different cases. The average case lasts about six weeks, though there are many cases in which a slight discoloration of the skin and scleræ exists for only a few days. No bilirubin, or only traces, are found in the urine, but large amounts of urobilin.

Other cases are of much longer duration, and may, with varying improvement and exacerbations, continue for months. This is usually due to repeated errors in diet, but some of these cases, especially such as display exacerbations associated with rises of temperature, may be due to relapsing infections of the bile passages.

Occasionally, however, all symptoms recede and only the biliary obstruction with its resulting symptoms remains for a longer period, so that the dreaded fear that a severe anatomical change may be present can only be dispelled by freeing the bile passages.

Prognosis.—Complications of icterus catarrhalis by a disease of the bile passages (purulent cholangitis, cholelithiasis), or of the liver parenchyma (cirrhosis, acute yellow atrophy) are rare. Relapses are quite frequent.

Treatment.—The treatment should first aim at rest and diet. Most patients feel prostrated from the toxic effect on the musculature, of the bile acids in the blood and tire very soon on physical exertion. Severe cases are best kept in bed, but in slight cases moderate exercise is indicated.

As Leichtenstern points out, the last traces of jaundice disappear

not rarely in convalescence just following getting up and walking about, and he believes that the movements have cholagogic action.

Certain remedies were formerly believed to have a cholagogic action, as rheum, which was used as powder, tincture, or infusion. No objection can be raised against the use of this drug, which has a favorable cathartic action.

According to the experiments of Lewascheff, the alkalies have favorable effect on the secretion of bile. The same action was ascribed by this author to sodium salicylate. Stadelmann and Glass, on the grounds of their investigations, denied the cholagogic action of alkalies because they do not pass into the bile. Nevertheless, the use of alkali is almost general in practice.

A. Pick, following the investigations of Lewascheff, as early as 1885 used sodium salicylate in many cases of epidemic jaundice, and since this time he has used it combined with sodium bicarbonate also in numerous cases of catarrhal jaundice and has obtained good results.

Karlsbad water is of undoubtedly favorable effect on catarrhal jaundice. One gives 100 to 200 gm. warm Karlsbad Mühlbrunn in the morning on an empty stomach, and the same dose half an hour later, or one hour before luncheon. If a tendency to constipation is present, 2 to 5 gm. of Karlsbad salts are added to the water, or it is mixed with 50 to 100 gm. bitter water. Of medicaments, chiefly cathartics are used, as rheum, aloes, calomel, jalapa.

In cases in which the examination of the urine points to increased intestinal putrefaction, the administration of dilute HCl, of menthol, or carbonate of cresote is indicated.

Water enemas have been recommended in the treatment of jaundice; thus the cold-water enema of Mosler, of 1 1/2 liters water at 50° to 20° C., which the patient should retain as long as possible. Winternitz advocates cold enemas of small quantities of water, given several times daily.

Gerhardt advocates stimulation of the gall-bladder to contraction or compression of the bladder to remove the hindrance in the duct, a method whose use is not entirely without danger.

In regard to the diet, milk deserves the first place, being the most useful food in jaundice. In severe cases, on account of the poor resorption of fat, it should be given without cream (centrifuge). Beside milk in the first days, we give light, floury foods without fat, rice, mashed potatoes, later green vegetables and stewed fruits; meat is given only on beginning convalescence: at first chicken, veal, broiled beefsteak, boiled fish, and boiled beef.

From the theoretical point of view, no one could object to meat in jaundice, but numerous cases have taught us that the disease takes a protracted course and is often followed by dyspeptic conditions,

so that we decidedly prefer a diet of milk and vegetables on the ground of extensive experience.

Nutrition of Small Children Suffering from Occlusion of the Bile Duct.—Hecht had occasion to convince himself of the advisability of using Holland milk in infants and small children suffering from biliary obstruction. Holland milk is a buttermilk, and has a very low content of fat; to each liter of the milk 4 tablespoonfuls of cane-sugar and 1 tablespoonful of flour is added. Another food suitable for small children, poor in fat and rich in carbohydrates, is Liebig's or Keller's milk-malt-soup. The mixture of milk and children's foods containing carbohydrates in a more or less predigested form is much in favor. With this diet we may succeed in accomplishing a considerable increase of body weight in an infant with completely acholic stools.

Impaction of Foreign Bodies.—Distoma.—By infection with drinking water, especially in tropical regions, invasion of distoma may occur into the bile ducts; a severe icterus is brought about in this way only when the hepatic duct is completely obturated by these parasites. The diagnosis is made by the demonstration of the eggs of the parasites in the stools.

The treatment consists in the administration of male fern extract and of laxatives. If the occlusion is not removed in this way, the bile ducts must be freed by operation, and eventually a cholecystenterostomy must be performed.

Ascarides.—In rare cases ascarides find their way into the biliary passages and produce icterus gravis or peritonitis or furnish a substratum for the formation of gall-stones.

Obstruction through Gall-stones.—The commonest cause of obstruction of the bile ducts is the impaction of a gall-stone in the duct. The symptomatic picture and the treatment of the colicky attack is treated in detail in the chapter on Pain in the Abdomen. Here the treatment of persistent obturation followed by icterus gravis will be discussed. This permanent jaundice, leading to death within a few months, rarely develops immediately after the first colicky attack, still more rarely does it appear suddenly without colic. If a complete obstruction to the bile exists and the dilated portion of the bile duct behind the stenosis gains no outflow for the bile by perforation into the intestinal lumen, or externally (biliary fistulæ), a dark yellowish-green discoloration of the skin appears, with intolerable itching, passing into the completely developed picture of cholemia, characterized by hemorrhages, nervous disorders, and finally coma. In some cases the obturation leads to ulceration of the mucous membrane which may furnish the ground for the development of an annular carcinoma.

On persistent closure of the common bile duct, surgical intervention alone permits any recovery, the stones being removed by incision into the duct.

As a palliative measure, a communication between the gall-bladder and intestine may act favorably, though there is the constant danger of cholecystitis from the immigration of intestinal bacteria into the gall-bladder (Dujardin-Beaumetz).

Icterus Gravis.—Between the lesser degrees of liver insufficiency and icterus gravis all possible degrees of transition exist. We use the latter term when the central nervous system reacts to the auto-intoxication by severe symptoms.

Symptomatology and Diagnosis.—Violent headache, state of excitement, furibundal delirium or somnolence, even coma, convulsions, and vomiting appear. There develops a tendency to hemorrhage in all organs and cardiac weakness, which usually is the immediate cause of death. If an acute degeneration of the liver parenchyma takes place, as in the acute yellow atrophy, the hepatic autointoxication due to the complete insufficiency of the internal secretion of the liver is associated with cholemia, the toxemia from retention.

Prognosis.—The involvement of the central nervous system, so important for the prognosis, may be simulated in common jaundice by a complicating nervous affection, and in this way cause a false diagnosis of icterus gravis (thus in a case of hysteria communicated by v. Leube).

The most important factor for the diagnosis lies in the secretory capability of the kidneys whose function it is to protect the organism against the accumulation of poisonous and toxic substances. Icterus gravis is constantly associated with severe injury of the kidney function, which usually gives way before the appearance of the severe cholemic manifestations, by decrease of diuresis and of the daily nitrogenous excretion. The symptomatic hemorrhagic diathesis, if coexisting, troubles the diagnosis considerably; this complication may occasionally be simulated by the accidental concurrence of jaundice and purpura.

On long duration, jaundice injures the state of nutrition and the hematopoiesis intensely and persistently. Nevertheless, even after a year, a benign jaundice may completely recover. On still longer duration or often only after months, death occurs without the primary disease itself being responsible.

Treatment.—The treatment of icterus gravis will be followed by success only if we succeed in fulfilling the indicatio morbi, *i.e.*, to render the flow of bile into the intestine again possible. Otherwise we must take refuge in symptomatic treatment, taking cognizance of the absence of the bile function in the digestion.

The nervous symptoms demand hydropathic, analeptic procedures, as baths with cold showers, if coma is imminent; in various disturbances of the sensorium morphin and chloral hydrate will be used. Certain procedures aiming at the removal of the poison from the organism may be tried, but hardly allow the hope of much success. In plethoric individuals, with a full, high-tension pulse, venesection of about 200 to 300 c.c. blood may be followed by the infusion of 500 c.c. of physiological salt solution. Stimulation of diuresis with the usual remedies may be tried (diuretin, calomel, etc.). Sweating in threatening cholemia accomplishes much less than in renal insufficiency, since the quantity of bile constituents leaving the organism in this way is a very small one.

Treatment of Itching of the Skin.—In chronic obstruction of the bile duct the pruritus is an intolerable symptom which robs the patient of sleep and in this way hastens his decline. It is not definitely decided whether the itching is caused by the retention of bile acids or by the deposition of masses of bilirubin on the endings of the sensory nerves or by a third agent as yet unknown. At any rate, no parallelism can be traced between the intensity of the jaundice and the pruritus. In catarrhal jaundice it may precede the yellow discoloration of the skin and sclera, and in cirrhosis and cholelithiasis it may occur without jaundice owing to the disturbed liver function (Andral). The number of remedies given for pruritus is very great, a significant proof of the ineffectiveness of all. One is obliged to vary the drugs frequently as their action fails very soon. The internal treatment is scarcely of any use, except for the powerfully acting narcotic remedies, which must be left for the extreme cases of necessity. One may try hot, luke-warm, or cold rubs, or baths with various ingredients, as bran, soda (100 gm. to 1 bath) sulphuretted potash, a decoction of oak bark, etc., or washing with vinegar and water. Leichtenstern reports good results from rubbing with sliced lemon. Sulphur and naphthol soaps, carbolic acid in 2 per cent. solution, menthol and thymol in alcoholic and oily solution, ointments and dusting powders may be used. Unna's zinc paste is sometimes of use.

Rp. Zinc. oxydat.,
Gelatin alb., āā 15.0
Glycerin, 25.0
Aq. destill., 45.0
DS. Warm, and paint lightly with brush over the body.

Ichthyol or tumenol (5 per cent.) may be added to this prescription. J. Ph. Pick and Jarisch have seen good results from the use of pilocarpin in slightly diaphoretic doses (10 to 20 drops of a 1 per cent. solution two times a day).

Congenital Defects of the Bile Ducts and Congenital Icteric Diseases.—Hemolytic Jaundice; Hereditary Icterus: *Cases of Moxon.*—Congenital closure of the common bile duct invariably causes death if due to an anomaly of development or to a fetal disease ending in cicatrization. Of greater interest clinically is the congenital, often hereditary, disposition to jaundiced conditions. Harley reports an observation of Moxon that two sons born jaundiced from an icteric mother had retained this icterus still in manhood; in other ways they were in the best of health, the liver not much enlarged, but the urine contained bile pigments. All the children of these two men were jaundiced at birth, but after a month the jaundice disappeared. Similar reports of such conditions are found in the literature. In a case of Glaister a high degree of stenosis of the common bile duct was found post mortem. Sometimes these jaundiced children die at once after birth; in other cases their health varies or is completely undisturbed. In a case communicated by Widal the urine constantly contained only urobilin, whereas in the blood serum also bile pigment could be demonstrated.

Cases of A. Pick.—The same conditions have been found by A. Pick in three cases which showed the following noteworthy history: The icterus existed in three children and in their mother from birth, while her three other children did not show this condition. The skin and mucous membranes were markedly yellow, the urine was free from biliary pigment and bile acids, the feces of normal color. The frequency of the pulse was 72 and 66, respectively, therefore not much decreased, whereas the patient of Widal showed a pulse between 40 and 60.

In explanation of these cases one must assume with a normal gross anatomical condition an abnormal communication between the finer lymph and bile passages or a congenital or hereditary insufficiency of the liver cells.

Cases of Minkowski.—But there are other cases of hereditary jaundice which have nothing to do with all these and which Minkowski characterizes as "hereditary affections with the picture of chronic jaundice, urobilinuria, splenomegaly, and renal siderosis."

Clinically, these cases recall the chronic infectious jaundice with splenomegaly as described by Hayem and Levy. To the conception of this family ailment as an infectious disease Bettmann objects; he observed in one case the periodic occurrence of hemoglobinemia without hemoglobinuria, and supposes therefore primary changes in the blood. This morbid condition may in rare cases be followed through three to four generations (Minkowski).

Jaundice from Tumors of all Kinds.—Carcinoma of the Gall-bladder.—In neoplasms of the gall-bladder, jaundice may, of course,

be entirely absent, but in the greater number of cases it is observed, on spreading of the tumor to the biliary passages or by stenosis in cases where a carcinoma has developed on the ground of cholelithiasis. The ulcers caused by pressure heal with formation of scars. Cholelithiasis is a frequent precursor of gall-bladder tumors. The diagnosis of carcinoma of the gall-bladder can only be made certain by palpation of the tumor. If this disease is suspected, an exploratory operation is advisable, since the prognosis is not necessarily fatal, if cholecystectomy is performed early enough. If icterus, ascites, and a marked tumor can be demonstrated, radical cure cannot be expected; by opening the gall-bladder the violent pains which constantly follow dropsy of the gall-bladder will, however, be immediately relieved.

Prophylactically, cholecystectomy should be performed if the presence of stone in the bladder justifies the opinion that the mucosa is exulcerated and the whole wall thickened or if a purulent inflammation is present. Also in patients with an hereditary predisposition to cancer this operation may conscientiously be advised if stones have been demonstrated in the gall-bladder.

Obstruction of the Bile Ducts by Tumors.—In the whole course of the hepatic and common bile ducts, as far as the opening of the latter into the duodenum, chronic obturation by tumors may occur; they may obstruct or compress the lumen or, not rarely, both conditions are associated. We may not necessarily have to deal with tumors *sensu strictiori;* the same results may be called forth by inflammatory products or by any formation which decreases the amount of space necessary for the normal functions. At the porta of the liver an aneurysm of the hepatic or superior mesenteric artery or of the abdominal aorta, an echinococcus cyst, a glandular tumor or adhesions of any kind on the porta itself or in the hepato-duodenal ligament, syphilis of the liver, carcinoma, adhesive perihepatitis, duodenal ulcer, and many other diseases may cause a hindrance to the flow of bile. Aortic aneurysm, enlargements of the pancreas, as cysts, or stones in the pancreatic duct, suppurative pancreatitis or carcinoma of the head of the pancreas may act in the same way, while carcinoma of the duodenum on the papilla Vateri will cause an absolute hindrance to the flow of bile as an early symptom.

Stenosis from Kinking.—All tumors of the colon, of the omentum, of the retroperitoneal organs, of the gall-bladder, even ovarian cysts and tumors of the uterus may occasionally lead to kinking of the common duct, and in this way to jaundice. Weisker states that also movable kidney may, by traction on its ligaments, cause such a kinking of the common bile duct, but this is not proved. Tumors of the right kidney, however, may hinder the bile flow.

Tumors of the Liver.—Tumors of the liver itself may lead to

chronic jaundice. Their localization is of great importance, as likewise secondary changes in the liver tissue. Of neoplasms, fibromas, adenomas, carcinomas, sarcomas, and cysts have to be considered. In spite of their benignity, fibromas may endanger life if they produce total obstruction. In primary carcinoma and sarcoma jaundice may be absent, but in the plurality of cases it is present, chiefly when a great number of the bile channels are compressed by the tumor masses or obstructed by the infiltration; further, if the porta hepatis is involved, with its lymph glands and those of the hepato-duodenal ligament; and finally on pressure of the large bile ducts by a tumor protruding from the lower surface of the liver.

Pressure Effects of the Pregnant Uterus.—Toward the end of pregnancy a jaundice of benign nature is observed not rarely, incited probably by pressure of the pregnant uterus on the liver, especially if at the same time a constricted liver and fecal obstruction in the colon are present (H. Quincke). The therapy consists in the removal of corsets during pregnancy and care for the normal function of the bowels. Severe jaundice in pregnancy may cause death of the fetus or premature birth.

Jaundice from Parenchymatous Affections of the Liver.—Liver Abscess.—In abscess of the liver there is usually a subicteric discoloration of the skin and scleræ which persists for a time even after recovery. A true icterus is usually not produced, because the abscess is rarely located at the porta hepatis and pressure plays no important part, as the tension in such a pus cavity is low. If severe icterus does develop, a complication leading to biliary obstruction must be suspected. Thus v. Leube reports a case of liver abscess with severe jaundice, in which postmortem "the first (purulent) thrombus was found in the trunk of the portal vein, exactly corresponding (*i.e.*, opposite) to a gall-stone lying in the hepatic duct.

Cirrhosis of the Liver.—Still rarer is jaundice in atrophic cirrhosis of the liver, if we neglect a slight yellowish tinge; the same is true in childhood, in which this disease takes a very rapid, almost subacute course.

In hypertrophic cirrhosis, on the other hand, jaundice acts in a way which may be recognized from the French nomenclature "cirrhose sans ascite avec ictere." The jaundice appears early with swelling and painfulness of the liver, taking a course parallel with these symptoms. Exacerbations of the whole picture, which occur with increasing intensity at intervals of several months, are followed by exacerbations of the jaundice until it becomes entirely persistent. The stools are usually poor in bile, though no absolute absence of biliary pigments exists. The urine contains abundant quantities of bile pigments.

That form of cirrhosis which develops from stagnation of bile produced by gall-stones is naturally associated with jaundice. Healing of the icterus after removal of the stones is said to be possible (v. Fragstein).

In the other forms of chronic interstitial hepatitis, caused by blood stasis or corresponding to the "cirrhosis avec stéatose" of the French, at most a slight subicteric tinge may be seen.

A marked yellow color is perhaps found most frequently in the malarial liver.

Atrophy of the Liver.—In simple atrophy of the liver the stool becomes very poor in bile and may occasionally assume the quality of the stool in jaundice; the latter, however, is not present, as inspection of the skin and sclera and examination of the urine prove. The cause of the peculiar aspect of the feces lies in the decreased production of bile.

Fatty Liver.—Similar are the conditions in fatty liver. The finest bile capillaries are not compressed by the liver cells filled with fat, nor is the protoplasm so severely injured that a passage of biliary constituents into the blood would be necessitated (G. Hoppe-Seyler). Therefore, no jaundice is observed in fatty liver, whose pathogenesis may be due to different factors (obesity, anemia, tuberculosis, chronic alcoholism, cachexia of carcinoma). If the nourishment has severely suffered, the secretion of bile is diminished, and this can be seen in the aspect of the stools. The excretion as urobilin in the urine may be less than that under normal conditions.

Amyloid Liver.—The production of bile in amyloid liver shows a similar behavior, sinking in pronounced cases. At the same time a decreased urea-forming function of the liver may be demonstrated by control of the urea excretion. Icterus can be found only if the amyloidosis has developed on the basis of a disease which itself leads to jaundice, as, for instance, an abscess which hinders the flow of the bile.

Acute Yellow Atrophy of the Liver.—The severe symptoms of acute yellow atrophy set in with very pronounced jaundice, which is due to complete biliary engorgement, as may be proved by examination of the feces, which are entirely free from biliary pigment and its derivatives. In the first days the picture is often similar to catarrhal jaundice, but this state is soon followed by a second one in which the liver may become very painful, its dulness decreases, and at the same time hemorrhagic diathesis and severe nervous manifestations appear. At the same time, the icterus increases if this is still possible. In rare cases the icterus appears only after other severe symptoms have arisen, or in a rapid course of the disease it may not develop at all (Bamberger).

Phosphorus Poisoning.—Since the liver of phosphorus intoxication has a great similarity with that of acute yellow atrophy, in the clinical as well as in the anatomical relations, it is here the place to speak of the jaundice associated with the phosphorus liver. Icterus is one of the most regular and characteristic symptoms of this intoxication, appearing on the first to the tenth day. Its intensity is parallel to the other manifestations, and is usually a quite reliable measure of the severity of the disease. The early jaundice of severe degree appearing only a few hours after the intoxication is prognostically unfavorable; sometimes, however, death may occur though the icterus has receded a great deal, owing to fatty degeneration of the heart, followed by cardiac weakness (v. Jaksch).

Hyperemia of the Liver.—In active hyperemia of the liver, which occurs in overfed persons of sedentery life, now and then the discomfort increases somewhat: they complain of fulness in the abdomen, pressure in the stomach, pain in the region of the liver, and, at the same time, a slight icteric color may be recognized. The latter may be due to changes in the liver tissue itself, as insufficiency of the liver cells, or to a slight catarrhal swelling of the mucous membrane of the common bile duct.

The treatment will consist in a temperate mode of life, abstinence from any kind of excesses, especially alcohol, care of the bowels, eventually drink cures at watering-places, as Karlsbad, Marienbad, Vichy, etc.

In a high degree of venous stasis, jaundice in more or less pronounced degrees is usually observed, leading only rarely, however, to the appearance of biliary pigments in the urine, usually only to an augmentation of the urobilin. Thierfelder states that the occurrence of jaundice depends on the nature of the disease which leads to the venous stasis; that it occurs more rarely in pulmonary affections than in cardiac stasis. H. Quincke, however, denies this. According to him, the explanation of the jaundice lies probably in the compression of the bile capillaries by the blood capillaries. Grawitz believes that the increased destruction of red blood-corpuscles and the resulting increased secretion of bile have to be considered as the cause of the jaundice. v. Noorden, too, regards the increased hemoglobin metabolism as the decisive factor, whether it occurs in the tissues or in the parenchyma of the liver.

If a cyanotic as well as an icteric discoloration of the skin is present, it is not easy to recognize a slight degree of jaundice. In these cases it may be of some assistance to render the mucous membrane of the lower lip anemic by pressure with a slide.

Lowered Blood Pressure in the Hepatic Vessels.—A form of jaundice different from those just mentioned is that which is said to be

due to a lowered blood pressure in the blood capillaries of the liver, producing a pressure difference between bile capillaries and liver capillaries. The fall of the biliary stream is thus changed, and a greater or less amount of bile thus passes into the blood.

Pylethrombosis, surprisingly, does not often lead to jaundice; in pylephlebitis, too, this symptom may be entirely absent. If present, it may be due to pyemia or to compression of the hepatic duct at the porta hepatis or to catarrh of the common bile duct. The explanation of the absence of jaundice in spite of a greatly reduced pressure in the liver capillary system can at present only be found in the somewhat arbitrary assumption of a still greater fall of pressure in the biliary system.

Frerichs believes he has observed cases of icterus, in stenosis of the portal vein, caused solely by this difference of pressure, without any compression of the bile duct by the vein, or any simultaneous obstruction, by pressure, of vein and bile duct.

Emotional Jaundice.—He tries to explain in the same way the jaundice from emotion, having the conception that the cardiac activity, as well as the respiratory movements, are weakened by violent emotions, as fright, while at the same time the abdominal vessels take up a great part of the total quantity of blood. In this way the pressure in the capillary system in the liver suddenly falls enormously, giving rise to the development of jaundice. Quincke gives another explanation for emotional jaundice. He thinks that in such cases we have to deal with spastic closure of the mouth of the common bile duct, since the contractility of the biliary channels is a fact beyond doubt. He emphasizes that several hours must pass between the inciting effect and the production of jaundice, since the passage of biliary constituents into the blood occurs only slowly, and even the imbibition of the skin with biliary pigments takes place only gradually, and only if the amount of biliary pigment in the blood is sufficient.

Those cases in which jaundice followed an attack of fright he explains by the assumption that the icterus, being already in a stage of development, has become manifest through the pallor. The fact that a slight degree of jaundice is more plainly visible on a pale skin or mucous membrane is used in the examination for jaundice, the mucous membrane being, as already mentioned, compressed, and in this way rendered anemic.

That an hysterical jaundice exists cannot be accepted, since, doubtless, many women are predisposed to jaundice and acquire it on the slightest cause. It is of importance to know the "hysterical cholemia" in the course of a benign jaundice in an hysterical individual. The intoxication with the biliary constituents attacks the sensible nervous system so violently that one receives the impression

of a severe case of cholemia with loss of consciousness, delirium, and convulsions. The differential diagnosis is rendered possible by the success of the antihysterical, *i.e.*, suggestive treatment. Hysterical convulsions may disappear after pressure on the ovaries.

Icterus Neonatorum.—Jaundice of the new-born is a physiological condition. Regarding the frequency of its occurrence different authors differ, so that, for instance, according to Seux 15 per cent. of the new-born have jaundice, whereas, according to Cruse, only the same number are free from it. This disparity is explained by the fact that a great number of children show only slight traces of the yellowish discoloration. The jaundice of the new-born appears in the first days, usually within the first two days after birth, and, according to its intensity, lasts from two days to two weeks. If it does not disappear at this time, or if it becomes even more intense, one must think of another more severe affection. In the differential diagnosis, sepsis, congestive jaundice, syphilis of the liver, and congenital obstruction of the bile ducts or aplasia must be considered. The icterus neonatorum is recognized by the yellow coloration of skin, mucous membranes, and scleræ.

The stools are not poor in biliary pigments; the urine contains only little bile coloring matter in solution, but this may be seen in the form of lumps and detritus, attached to the cellular elements of the sediment ("Masses Jaunes" of Parrot and Robin). The cause of this appearance lies, according to Knöpfelmacher, in the small amount of alkaline monoacid phosphates.

In the pathological icterus of the new-born, one finds bile pigments much more commonly than in the physiological jaundice, which may be due to the changed solubility of the bile pigments in the urine from the altered metabolism. Halberstamm found bile acids. The toxic bradycardia is absent, not only in the new-born, but also in the first decade of life. The intensity of the jaundice varies according to certain laws. Premature children and debilitated children show a very marked and persistent icterus, and Cruse found that body weight and jaundice are inversely proportional. According to Kehrer, children of primiparæ have a more intense degree than those of multiparæ. Farther, there exists certain parallelism between the erythema and the jaundice of the new-born; moreover, the plethora, which appears on expression of the placenta and on late ligature of the umbilical cord, favors the occurrence of jaundice.

Theories.—Very numerous theories have been constructed to explain the icterus neonatorum, and these at the same time reflect the whole change in our conception of all other forms of jaundice.

Some authors put the blame on the absorption of biliary pigment from the intestines, others on the liver parenchyma. This process

in the liver is, according to Virchow and Kehrer, due to a hindrance in biliary passages, whereas Frerichs also in the jaundice of the new-born applies his theory of the lowered pressure in the portal vein and its branches. Others see the pathogenetic factor in the destruction of erythrocytes, and in the resulting augmentation of bile (polycholia), since abundantly produced bile also possesses a greater viscosity. Parrot and Epstein believe that the bile pigment is formed directly from the hemoglobin, and consider icterus neonatorum as purely hematogenous without the intervening state of polycholia. The place of transformation for them is the whole blood channel, whereas Schultz and Zweifel place this metamorphosis in the tissues, in the erythematous skin, and in the areas of minute capillary blood extravasations (Inogenous Icterus of H. Quincke).

Of all the theories founded on the absorption of bile from the intestine, that initiated by P. Frank and farther developed by H. Quincke is the most attractive. The intestinal content of the new-born is rich in biliary pigment, since the secretion of bile is greatly stimulated by the intake of food and the meconium is very rich in bilirubin (according to G. Hoppe-Seyler 1 per cent.).

In adults the bile constituents are taken up in the liver, and are again excreted in accordance with the known circulation of the bile. In the new-born, on the other hand, a direct invasion of the general circulation by the bile pigments occurs through the communication of the portal vein with the vena cava by means of the ductus venosus Arantii. Abramow introduced a new conception of icterus neonatorum, explaining it by asthenic polycholia. He believes that the bile production is abundant but that the pressure of secretion is not sufficiently high, and this deficient energy of secretion he again ascribes to the congestive hyperemia.

The prognosis of jaundice of the new-born is always favorable, though O. Schaffer states that severely icteric infants lose much in weight, but it has not been shown what is cause and what effect in this syndrome. There of course does not exist any treatment for this physiological condition.

Intoxications.—Many intoxications by substances which are commonly designated as poisons, as well as by decayed food, lead to jaundice.

Picric Acid.—The picric acid intoxication must not be confused with toxic jaundice; it has, in earlier times, been observed following the medicinal use of potassium picronitrate, as a vermifuge. Here the bile acids and pigments are of course absent from the urine. On great doses of picric acid the red blood-corpuscles become dissolved, producing hemoglobinemia. In this case a true jaundice may develop.

Hemolytic Poisons.—Other poisons leading to hemolysis and

jaundice are arseniureted hydrogen, toluylendiamin, and certain mushroom poisons, as hellvellic acid contained in hellvella and phallin contained in amanita phalloides (v. Jaksch). In intoxication with arseniureted hydrogen the prognosis is unfavorable if jaundice and hemoglobinuria have once developed. The same is true in poisoning with amanita, while that with hellvella gives a somewhat more favorable prognosis. It is interesting that hellvella esculenta is as poisonous in the dried state as in the fresh, but that this poisonous action disappears if the mushrooms are repeatedly extracted with hot water.

Substances Producing Methemoglobin.—Another group of poisons, as potassium chlorate, pyrogallol, anilin and its derivatives (antifebrin), and nitrobenzol, etc., act destructively on the hemoglobin, transforming it into methemoglobin. In these poisonings the color of the skin is not a pure yellow, but, owing to the methemoglobinemia, of a brownish hue. At the same time, severe cyanosis may obscure the jaundice. The methemoglobinuria occurring simultaneously need not parallel the jaundice in intensity.

Intoxications Associated with Jaundice of unknown Pathogenesis.—*Ether.*—Certain other poisons also are believed to produce jaundice by destruction of red blood-corpuscles. This has been asserted of ether, chloroform, and chloral hydrate, though this effect has not been observed by clinicians. Naunyn, however, observed that after subcutaneous injections of ether into rabbits, biliary pigments frequently appeared in the urine; this finding was more constant after the injection of ether into the small intestine. It is generally known that ether lakes the blood *in vitro.*

Extract of Male Fern.—In administering the ethereal extract of male fern, jaundice is not infrequently observed, even after the usual dose. To avoid intoxication by filicic acid, the poisonous principle of this extract, it is necessary to avoid castor oil as a cathartic, since oils, being good solvents for this acid, favor its resorption. This drug is perhaps better substituted by the extractum aspidii spinulosi, which does not act as promptly but may be given without fear. If extract of male fern is prescribed, the greatest caution should be used; children should receive 1/2 to 3 gm., adults 5, maximal 8 gm.

Santonin.—Still another anthelmintic may lead to icterus with severe signs of intoxication, santonin, the active principle of florescinæ.

Lead.—In chronic lead poisoning icterus may develop, but it need not necessarily be explained by the injury to the red blood-corpuscles, as the idea of a spasm of the common bile duct is very plausible in the symptom-complex of lead colic.

Tuberculin.—In the course of a strong tuberculin reaction one sees occasionally a jaundice develop.

Snake Venom.—After snake bites one finds jaundice and other signs of dissolution of blood, as hematemesis and hemorrhages of all kinds, especially if the poisoning runs a protracted course, as after the bite of rattlesnakes.

Jaundice Following Blood Extravasation.—Several days after the occurrence of blood extravasation following injuries with blunt instruments, or from hemorrhagic diathesis, from tubal abortion, or tubal rupture, a slight degree of yellow discoloration of skin, scleræ, and mucous membranes may develop, which disappears after a few days, at the latest after two to three weeks. There usually appears before the jaundice an increased quantity of urobilin in the urine, while only in very rare cases nonreduced biliary pigments are excreted. Since hematoidin crystals are observed in the extravasation, one could think that the transformation of hemoglobin into bile pigments occurs *in loco* and that they are diffused from there. The discoloration of the skin which follows effusions teaches us that the yellow color appears only very gradually, after about a week, and never attains great dimensions. One has to regard this jaundice, therefore, as a hepatogenous one, the hemoglobin set free being taken up by the liver and there being transformed into bile.

After slight effusions of blood one observes sometimes, though no jaundice, a urobilinuria; the formation of urobilin outside the digestive tract seems possible, for even on complete occlusion of the bile from the intestines urobilinuria appeared following extravasation of blood, as D. Gerhardt has observed.

Icterus in Hemoglobinemia.—Since the absorption of dissolved hemoglobin produces jaundice and, farther, since also the toxic icterus is due in many cases to hemolysis we will not be surprised to find jaundice in the essential hemoglobinemia. One also finds in the urine bile pigments, but no bile acids (v. Leube). This might be considered as due to polycholia, but it must be remembered that the severe changes in the blood may of themselves injure the parenchyma of the tissues and cause an affection of the liver in the same way that it sometimes gives rise to acute nephritis.

Icterus in Winckel's Disease.—The same pathogenesis may be thought of for the jaundice in Winckel's disease, though a third possibility must also be considered. We may have to deal with the specific action of the still unknown infective agent of this epidemic disease. This is a very rare condition consisting in afebrile cyanosis with severe jaundice and hemoglobinuria; it attacks healthy infants in the first days of life, and leads, with severe gastrointestinal symptoms, convulsions, and collapse, to death. The blood is hemolyzed, of a dark brownish color, and thick; and under the microscope abundant masses of detritus are seen. In this condition we certainly

have to deal with an infection. Strelitz and Finkelstein believe it to be a streptococci septicemia; Lubarsch suspects the bacillus enteritidis, Gartner and Wolozynski, the bact. coli.

Infectious and Epidemic Icterus.—One sometimes finds cases which render it probable that some forms of jaundice are due to an infection. A. Pick in 1885 observed an epidemic of catarrhal jaundice, which attacked chiefly soldiers, but also private persons, however, exclusively adults. The disease was not limited to towns only, but prevailed in places situated at a high altitude (in the Herzegowina). The disease in some cases was followed by moderate fever, which receded to the normal on the second or third day. But in the greater number of cases no fever was present. Severe pains in the stomach region, and sometimes pronounced intestinal colic, announced the onset of the disease. The next day the conjunctiva was yellowish, and on the second day the yellow color of the general integuments became visible. In a few cases the epigastric pain appeared just at the time of the icteric discoloration. In the beginning, constipation was usually present; the appetite, usually very low in the first few days, again returned on the fourth or fifth day. The pulse was moderately retarded, the urine, of dark brown color, contained a considerable amount of biliary pigments; the feces were clay colored. No enlargement of the liver could usually be observed, but in the region of the left lobe tenderness was sometimes present. A striking appearance was shown in the first days by the gingivæ. Even on slight pressure in some cases they would bleed; in others there developed an ulcerative gingivitis. The gums were swollen, and were of a dirtyish dark red or sometimes of a pale color. Their free margins showed necrotic degeneration, reaching up between the teeth. In many cases ulcers developed on the inside of the cheek. They were situated behind the last molar or at the height of the closure of both rows of teeth; they started in the form of a great number of small ulcers about the size of a millet seed which then fused into larger ulcers with irregular fringed margins and a dirty gray necrotic floor.

In regard to complications which occurred in this disease, a case of urticaria and of articular rheumatism were observed and in many cases there existed acute bronchitis. The duration of the disease was very short in the greatest number of cases; some very slight cases lasted only a few days, and only the obstinate ones took four weeks for complete recovery.

School Epidemics.—The occurrence of jaundice in the form of school epidemics is a remarkable fact. Thus Stoos reports that in Beatenberg, a little village in Germany, fifty children attending the same school were taken with jaundice in three months, while in the three other schools of the community no case of jaundice was observed.

War Epidemics.—Jaundice has been repeatedly described as epidemics attacking armies. In the first year of the North American War, eleven thousand soldiers were seized with jaundice. The course of this epidemic jaundice in adults is a mild one, free from fever, and quite similar to catarrhal jaundice. In children, however, fever is very rarely absent; the disease sometimes begins with a chill. Of interest are those cases of jaundice in childhood in which the disease begins with tonsillitis.

Weil's Disease.—Weil in 1886 described a severe acute infectious disease, characterized by a peculiar course of fever, splenomegaly, and nephritis, and as its most constant symptom, jaundice, which appeared three to five days after the onset. The etiology of this disease does not seem to be a uniform one. For some cases the bacillus proteus fluorescens has probably to be considered the specific agent, which Jäger in 1892 cultivated from the organs of a postmortem case. The opinion that we here have to deal with a peculiar localization of typhoid fever, an idea which still finds its expression in the term of the French "typhus hepatique," has been refuted. The disease usually begins with a chill, severe muscular pain in the thighs, and great prostration. The nervous manifestations, somnolence and delirium, appear much sooner than in typhoid fever. The stools in the beginning are frequent, diarrheic, of normal color, but later, with the appearance of jaundice, they become discolored. Jaundice is almost never an early symptom; in some cases it begins when other symptoms are already receding. Liver and spleen are usually enlarged, albuminuria is frequently observed. A few days after the acme of the fever has been reached, the defervescence starts in the form of lysis, after which the icterus usually lasts still two or three weeks. Relapses occur in some cases, but without attaining the intensity of the first attack. The prognosis is favorable except in those cases in which the hemorrhagic diathesis indicates a specially severe course. The treatment is the same as in typhoid. Of the medical remedies sodium salicylate, which A. Pick used successfully in the above-described epidemic, may be recommended.

Suppurative Cholangitis.—Suppurative cholangitis, the purulent inflammation of the biliary passages due to infection, is to be considered as one of the etiological factors of jaundice. It occurs as a complication or sequela of acute infectious diseases, as typhoid fever, dysentery, and pyemia. In this connection we may remember that the serum of patients affected with this jaundice sometimes agglutinates typhoid bacilli and also paratyphoid bacilli. We are, therefore, not justified in concluding from a positive agglutination test that in fact we have to deal with an infection with typhoid or paratyphoid (Netter).

Suppurative cholangitis is usually produced by an immigration of microbes from the intestine through the common bile duct. Since this invasion of microorganisms proceeds against the bile stream, biliary congestion favors very much the occurrence of cholangitis in the same way as the ascending infection in the urinary passages is more easily produced on urinary stasis. The infective agents are usually colon bacilli, sometimes streptococci; in complication with pneumonia, the diplococcus of pneumonia may be found with other cocci, as well as colon bacilli. It is not improbable that not only cholangitis, which may appear as a complication in pneumonia, but also a slight jaundice which sometimes accompanies inflammation of the lungs, are to be traced back to slight infection.

In Asiatic cholera the comma bacilli frequently immigrate into the biliary passages, but only in rare cases do they produce purulent cholangitis or cholecystitis. In typhoid fever, typhoid and colon bacilli have been found only seldom in the bile passages (Gilbert and Dominici). According to Quincke it cannot be disproved that the bacilli reach the bile passages from the liver parenchyma where they are occasionally found, though the possibility of immigration through the common bile duct must be first considered.

Diseases of the Gall-bladder.—The affections of the gall-bladder, whose diphtheric form has been described by Rokitansky, and that of the large bile ducts consists in ulcerative processes, leading to the formation of pseudomembranes and later on to jaundice, liver abscess, and perforative peritonitis. The process may heal with a cicatricial stenosis of the bile ducts, which then causes jaundice and hydrops of the gall-bladder. A necrotic cholecystitis may, as Chiari first proved, develop from typhoid infection alone; after months even, typhoid bacilli could be cultivated from the purulent content of the gall-bladder (Dupre-Dörr).

The relation of suppurative cholangitis to general sepsis may be of two kinds. First, sepsis may develop in the course of a purulent cholangitis and cholecystitis. In these cases the primary disease is frequently cholelithiasis, in whose course there occurs immigration of colon bacilli, or more rarely pneumococci. Or in the second place a purulent pylephlebitis may follow the infection, giving rise to the formation of metastatic foci of pus, to bacteremia or septicemia. Jaundice may be completely absent in these cases; also in the course of infections not localized in the biliary passages, abscess in the liver may be produced by way of the blood stream, leading secondarily to suppurative cholangitis. The differential diagnosis between Weil's disease and cholangitis is sometimes difficult. Preceding gall-stone colic, fever of the intermittent type or the demonstration of liver abscesses speaks for the latter affection.

Jaundice in Infectious Diseases.—In the various acute infectious diseases a jaundice, usually not very pronounced, may be observed, though occasionally it may be a special feature of the morbid condition.

Typhoid Fever.—Jaundice in typhoid fever is by most authors, as Liebermeister and Griesinger, regarded as an unusual symptom, so that only seldom is it confused with Weil's disease. The pathological changes in typhoid fever increase gradually toward the ileocecal valve, whereas the upper portions of the intestines are almost normal. If a very pronounced jaundice is observed, we must first think of a complication with gall-stones, but we may have to deal with a purulent cholangitis and liver abscess, leading to pylephlebitis, or with pyemia with metastasis in the liver. Acute yellow atrophy of the liver may, exceptionally, develop in the course of typhoid fever, producing marked jaundice, but otherwise taking the same anatomical and clinical course as usual. Also in the course of typhoid fever, severe jaundice may be observed, namely, if a stenosis of the common or hepatic bile duct should develop from cicatrization of an ulcer; such a condition yields only to surgical intervention. Tissier observed the interesting fact that sometimes a considerable amount of urobilin is to be found in the urine of typhoid patients.

Exanthematic Typhoid.—Whereas, in exanthematic typhus, symptoms of cloudy swelling of the liver, fatty degeneration or congestion are frequently observed postmortem, jaundice plays no great part; in recurrent fever, on the other hand, it is a frequent symptom.

Recurrent Fever.—In recurrent fever one finds, postmortem, usually an enlarged liver, due to cloudy swelling, fatty degeneration, congestion, or interstitial small-cell infiltration. In some cases the liver resembles that found in acute yellow atrophy; it is then decreased in size, soft in consistency, and very icteric. The enlargement of the liver may be recognized clinically, receding during apyrexia, only to swell again at the next relapse, or perhaps persisting in the swollen condition even in the afebrile state. The icterus may be barely visible, or attain the greatest intensity. A parallelism between the swelling of the liver and the jaundice does not exist; but it does between the latter and the course of the fever, though the jaundice does not appear with the onset of fever, rather a few days later, and disappears only after defervescence. Immediately before the crisis, the jaundice usually attains its highest intensity. In some cases the jaundice becomes more pronounced only in the relapses. It accompanies both slight and severe cases, but only where it is very marked, *i.e.*, where it leads to intoxication with bradycardia and vomiting, does it have any influence on the prognosis. A severe septic picture, the bilious typhoid, may then develop; of this we shall speak later.

The genius epidemicus certainly plays some rôle in the frequency

of jaundice; epidemics with 1 per cent. and those with 30 per cent. of icterus have occurred (Curschmann).

Though the feces are usually poor in bile or entirely free from it, no hindrance to the bile flow can be found in most cases. It is not possible, therefore, to ascribe the jaundice to biliary engorgement; we must think of changes in the liver parenchyma or of hemorrhagic factors due to severe infection.

Bilious Typhoid.—Bilious typhoid was first connected with recurrent fever by Griesinger. Recurrent spirals have been found in the blood of these patients. Other authors, as Cornil and Babes, believe that we have to deal with a different agent, and still others consider that this disease is produced by certain mixed and secondary infections, ascribing the chief rôle to septic bacteria. Severe icterus, hemorrhagic diathesis, pyemic metastases, and severe nervous symptoms are almost constantly present, sometimes even the picture of acute yellow atrophy of the liver. The recurrent type of fever may pursue an irregular course, chills and sweats being present. The icterus begins usually on the fourth to the seventh day, leading to the common symptom of icterus gravis. The prognosis is very serious, tending rather to a fatal end.

Malaria.—In all forms of malaria a light degree of jaundice may occur. In the tropical and subtropical malarial regions the pernicious biliary fever or the remittent biliary fever attacks chiefly the unacclimatized foreigner. It is characterized by gastric disorders and jaundice, the type of the fever being usually that of the malignant tertiary form with remitting course, which may change to the intermittent form under the influence of quinin.

The jaundice, which usually arises during the prodromal symptoms, does not often become more intense. The stools contain bile, so that the jaundice must be explained by a polycholia due to the destruction of the erythrocytes. Also the blackwater fever, the febris biliaris hemoglobinurica, is constantly associated with jaundice, which, present at the onset in a lesser degree, becomes very intense during the hemoglobinuric attack.

In chronic malaria the skin is usually of a pale brownish color, but jaundice is not present.

Pneumonia.—Jaundice in pneumonia is in some cases an accidental complication. Aside from these, pneumonia may be combined with an icterus which plays an essential part in the clinical picture, so that Traube and Mosler constructed a condition *sui generis*, the bilious pneumonia. This is characterized by severe nervous manifestations, with decreased sensibility, and a tendency to diarrhea. Aufrecht emphasizes that pneumonia caused by the diplococcus of pneumonia is complicated by jaundice only if a simultaneous obstruc-

tion exists in the common bile duct. Such pneumonia with jaundice generally has a favorable prognosis. But in bilious pneumonia, the diplococcus is not found, but other pathogenic bacteria, which cause on the one hand pneumonia, on the other a severe injury to the liver parenchyma. The prognosis of this affection is unfavorable. The coexistence of jaundice in severe acute infectious diseases has repeatedly led to doubt in the diagnosis between pneumonia and liver affections on the one hand, and between acute yellow atrophy and abscess of the liver on the other. In children, jaundice occurs less frequently in pneumonia than it does in adults.

Dysentery.—Liver abscesses, as is well known, are frequently observed in dysentery, and may indirectly lead to icterus from biliary engorgement. But also, without liver abscesses, a slight degree of jaundice in skin and conjunctivæ may be present, as well as fever, headache, and bilious vomiting, a picture which may be considered as the bilious form of epidemic dysentery (Kartulis).

The Acute Exanthems.—After the disappearance of the exanthem, a peculiar brownish discoloration of the skin is to be observed in measles and scarlet fever which should not be mistaken for jaundice, something fairly possible if the exanthem is slightly hemorrhagic. The examination of the scleræ, however, soon gives certainty, though on sufficient practice the tint of the skin scarcely gives rise to any diagnostic doubts.

At the acme of the scarlet fever exanthem, a true jaundice may be observed. If one rubs the finger along the dark red skin, the icteric discoloration may be plainly seen. The inspection of the scleræ and the oral mucous membrane convinces us that we do not have to deal merely with a contrast effect. E. Wagner described a peculiar involvement of the liver, consisting in macroscopically visible lymphatic nodules and a small cell infiltration in the connective tissue. But this interstitial hepatitis sometimes observed in severe infectious diseases seems to have no special importance.

In the urine of severe cases of scarlet fever with jaundice, biliary pigments are usually absent, but urobilin is abundantly found. This, as above mentioned, does not permit us to speak of urobilin icterus in scarlet fever, in the sense that no biliary pigments are present in the skin. At any rate, jaundice in scarlatina affects the prognosis of the disease.

In variola, jaundice plays no rôle; on the revaccination of 200 workmen in Bremen an epidemic of jaundice was observed, which was probably due to a mixed infection.

Septic Diseases.—Jaundice, though of slight degree, is frequently observed in septic and pyemic processes. It is found following traumatic infections, in cryptogenetic septicemia, in severe puerperal

processes, and in ulcerative endocarditis. Postmortem, the liver is almost constantly enlarged, owing to cloudy swelling of its parenchyma or to cardiac insufficiency. Clinically, one finds enlargement and tenderness of the liver, and, in rare cases, a perihepatitic fremitus.

Sepsis in the New-born.—In sepsis of the new-born also, jaundice is frequently observed, especially in the umbilical sepsis due to septic thrombosis of the umbilical vein. Umbilical phlebitis is usually associated with umbilical arteritis. Local symptoms on the part of the umbilical region may fail, even in the most severe cases, and even on pressure of the umbilical wound no pus may appear. The oozing of blood, however, is suspicious if it occurs at a time when the umbilical vessels should already be obliterated. Of great importance for the diagnosis is a jaundice which increases in intensity from day to day. Porak and Durante designate it as "ictère bronzé," since the skin takes on a dark brown color. This jaundice is connected with the general sepsis in its pathogenesis or is due to the spreading of the disease from the umbilical vein to the liver, calling forth parenchymatous degeneration of the organ. The test for bile pigments in the urine is positive, whereas such is usually not the case in icterus neonatorum.

Yellow Fever.—Of greatest importance is the jaundice in the clinical picture of yellow fever, which, in the southern parts of the United States and especially in Mexico and Brazil, causes great devastation among the population. According to Sodré and Couto, in the lightest cases the yellow color may be limited to the conjunctivæ; in severe cases it spreads from there to the nasal and oral regions, then to other parts of the face, to the trunk, and thus, spreading from above downward, it finally reaches the extremities. It is an interesting fact that, in rapid cases, the icteric discoloration may appear only postmortem, and that in one case disseminated icteric spots were observed before they became confluent in the eruption stage of the yellow fever. Sodré and Couto believe the jaundice of yellow fever to be hematogenous, chiefly because neither in the liver nor in the gall-bladder and biliary passages can the bile pigment be found. The transformation of hemoglobin into bilirubin, under the influence of the yellow fever toxin, is said to be performed outside the liver.

In regions where yellow fever is endemic, its differentiation from icterus gravis may be very difficult. However, an enlarged tender spleen will speak against yellow fever.

Influenza.—Extremely variable are the reports of different authors on the frequency of jaundice in influenza. During the great pandemic in the winter of 1889–90, Bäumler found a slight discoloration of the scleræ in about 80 per cent. of cases, and ascribed, therefore,

great diagnostic importance to this frequent symptom. However, if one considers only those cases in which a profound icterus is present, the proportion is quite a different one. Thus Leichtenstern found among 439 cases of influenza only two complicated by jaundice, and other authors of great experience have never observed this symptom. It is evident that these great differences must depend on the region and the character of the epidemic, as it is not possible to ascribe them to a different conception as to those shades of discoloration which should be designated as jaundice. Altogether jaundice is a rare symptom in influenza, due probably to mixed infection when present.

Syphilis.—In recent syphilis, the appearance of jaundice is observed. According to Fournier, it occurs very frequently, but disappears very rapidly. Other authors consider jaundice a symptom of no special significance in syphilis. I. Neumann gives the following points of value in establishing a relation between jaundice and recent lues: first, the coincidence of jaundice and a swollen, sensitive liver, with the eruption of the exanthem or, what is rare but of much weightier evidence, relapse of jaundice on relapse of exanthem; next, the favorable influence of antisyphilitic treatment will speak entirely for such a connection. As diffuse and gummatous interstitial hepatitis with intense jaundice is observed chiefly in the tertiary state, one designates the jaundice of the secondary stage as icterus precox. It is variously ascribed to the compression of the common bile duct by lymph glands; to an exanthem of the mucosa; to syphilitic thickening of the vessel walls and the resulting compression of the biliary passages; and to the hemolysis caused by the syphilitic toxin. Clinically, syphilitic jaundice resembles catarrhal jaundice, but the common pathogenetic factor of the latter, a dietetic error, may be absent in the anamnesis. The stools at the height of the disease are usually, if not always, acholic. Fever is present, and luetic eruptions on the skin and mucous membranes are especially abundant. Werner observed, in the greatest number of cases, marked swelling of the lymph glands. The jaundice recedes usually after three to four weeks.

A few cases of syphilitic icterus combined with acute yellow atrophy are reported in the literature.

Engel-Reimers found in his three cases a pronounced swelling of the portal lymph glands which does not fit to the normal picture of acute yellow atrophy.

In the interstitial hepatitis of the tertiary stage jaundice, with biliary pigments in the urine, is frequent. Severe cholemia is rare. Through compression of the larger bile ducts by gummatous nodes or their resulting cicatricial constriction icterus is produced in some cases.

In hereditary syphilis of the new-born grave icterus is observed,

which leads rapidly to death. No complete biliary occlusion is present, the stools are of normal color, but the urine shows biliary pigments.

This condition is readily understood, as syphilitic products may be found in the liver of a syphilitic fetus. Also in elder children, subjects of hereditary syphilis, jaundice may be present as the external symptom of a liver affection.

Menstruation and Pregnancy.—Common catarrhal jaundice may occur in pregnancy, usually pursuing a favorable course. There are infectious toxic forms with severe cholemic symptoms which, according to Miclescu, furnish an indication for interrupting the pregnancy. Sometimes the icterus is believed to cause death of the fetus or spontaneous abortion.

The occurrence of jaundice with swelling of the liver and discoloration of the stools during menstruation was first observed by Senator, who ascribes it to a swelling of the mucosa of the common bile duct caused by the hyperemia. Metzger believes that a reflex contraction of the bile ducts may arise during menstruation, in this way leading to biliary engorgement.

Postoperative Jaundice.—De Boris has observed a benign jaundice following operations, but disappearing in a few days; this he ascribes to reflex action (ictères benins post-opératoires).

Icterus of Inanition.—On abstinence from food for several days, a slight degree of jaundice with traces of bile pigments in the urine has been reported in a few cases. Also in starving dogs bile pigments have been found in the urine. The decreased peristalsis of the bile ducts and the lowered blood pressure in the portal system during starvation favor the resorption of the bile pigments.

CHAPTER XI

EXAMINATION OF THE ABDOMEN

A. ABDOMINAL PAIN

General Remarks

The number of diseases in which abdominal pain may be present is so large that our description can scarcely aim to be complete; only the chief types of this symptom may be discussed. It must be mentioned here that children, especially in the first years of life, and unintelligent adults also are very unreliable regarding the localization of pain. Thus, for instance, we often find that three- to four-year-old children complain of pain in the abdomen, while examination shows a follicular angina.

Diseases located outside the abdomen not rarely produce pain within it. Pneumonia, for instance, may start with pain in the flanks (pseudoappendicitis of Garreau).

All organs of the abdomen may be the seat of pain, though in some not the parenchyma itself, but only the peritoneal covering or capsule may be the locus doloris. Thus, diseases of the liver, even if they attack the parenchyma extensively, produce a sensation of pain only if the peritoneal layer is involved or if a sudden enlargement of the organ stretches the capsule.

If a patient complains of pain in the abdomen we have first to inquire as to its location and character; then, whether it was of sudden onset or increased gradually to its maximum. We shall have to determine whether the pain is associated with meteorism or not, if it is influenced by pressure, augmented or allayed, and if it has led to collapse. In general, it may be stated that a lessening of the pain on pressure speaks against an anatomical affection, the same with absence of sensibility on pressure. In examining for pain on pressure stress must also be laid on whether the pain on pressure is increased when the latter is exerted more deeply. Watson called attention to the fact that augmentation of pain on increased pressure is characteristic for peritoneal irritation, whereas in hysterical tenderness pressure even on a lifted fold of skin is very painful. In ulcer of the stomach a painful point of pressure is located in the back, left of the spine; in duodenal ulcer and cholecystitis at the right of the spine about two to three fingers' breadth from the twelfth thoracic vertebra (Boas).

For the semiotic value of tenderness on percussion W. Ploenies gives the following points:

In typhoid fever, at an early period, tenderness on percussion exists in the region between the navel and the ileo-cecal region, sometimes lasting longer than the fever and being a certain indication as to the extinction of the process. For the diagnosis of acute and chronic appendicitis, of cholecystitis, of duodenal, pancreatic, and renal affections, the demonstration of a regional zone, tender on percussion, is of value.

In arteriosclerosis of the mesenteric artery this tenderness is absent in the periods intervening between attacks. Peritoneal irritation and threatening perforation may sometimes be excellently localized by soft percussion.

If on the gentlest percussion intolerable pain exists over the whole abdomen, the existence of a diffuse peritonitis is very probable. Indeed, with this method one may accurately follow the spreading of a peritoneal process. Tenderness on percussion is usually absent in membranous colitis, unless at the same time ulceration is present. Of whatever nature ulcers are, they are usually very sensitive to percussion; the same is true of malignant tumors of the stomach, intestines, and the liver, of inflammatory processes of the bile passages, of gall-stones, of acute intestinal occlusion, and of the round ulcer of the stomach.

Acute and chronic gastritis without erosions show no sensitiveness on percussion; in nervous hyperalgesia of the gastric wall the sensitiveness is very diffuse, in gastric crises completely absent. If in gastric ulcer the sensibility even on gentlest percussion is enormous, then danger of perforation threatens.

Let us now turn to the pain evinced by the various organs.

Stomach

Hyperchlorhydria.—In hyperchlorhydria we often find spasmodic attacks of pain which may continue even for hours, setting in usually one to three hours after meals. Occasionally they lead to vomiting, which may then end the attack of pain. Its intensity is not the same on each day, and varies according to the quality of the food. The patients do not usually complain of pain at night; the state of nutrition is usually good. It is remarkable that very abundant meals often cause no pain, due to the fact that the HCl is fixed by the great amount of food and strongly diluted by the large quantity of liquids drunk. For the differential diagnosis it may be mentioned that the administration of bicarbonate of sodium or burnt magnesium removes the pain temporarily or even completely.

The patients often mitigate the attacks by taking milk in small

portions. The observance of an appropriate diet is of greatest importance for the treatment. Biedert and Langermann recommend the following menu:

"In the morning, at 7 to 8 o'clock, 500 c.c. milk, 40 gm. toast; 10 A. M., 70 gm. roasted or hashed sweetbreads or beefsteak or chicken, 30 gm. toast, 1 to 2 pieces zwieback (20 gm.), 1/8 liter wine (125 gm.).

"12 Noon: Bouillon with egg; 140 gm. roasted or boiled chicken. Roasted meat—hash, 200 gm. raw meat, as beefsteak, or 140 gm. finely hashed boiled corned beef or the corresponding quantity of fish, asparagus with cream, 20 gm. toast; 1 omelette soufflé, a small cup of black coffee.

"4 P. M. 250 gm. milk, cocoa; 3 zwiebacks.

"7 P. M. 70 gm. cold meat with 100 gm. meat jelly; 20 gm. toast, 20 gm. Swiss or Dutch cheese."

At the height of digestion, alkalies may be given without fear of the stimulation of an increased production of acid. Bergmann advises having the patient chew gum after meals to stimulate the secretion of saliva, which with its alkaline reaction neutralizes the gastric acid to some degree. The drinking of Karlsbad water has the same effect,

If the pains are very violent, codein may be added to the alkalies; for instance, 0.5 gm. of the hydrochlorate of codeine to 30 gm. of sodium bicarbonate, to be taken in knife-point doses, or 0.03 gm. of extract of belladonna *pro dosi* (Biegel).

Chronic Hypersecretion of Gastric Juice.—(*Chronic Gastric Sucorrhea*).—In chronic gastric sucorrhea the patients suffer still more from pain which always reaches its highest intensity before meals and about at midnight. After the meal it usually ceases. In combating this pain an abundant protein diet, alkalies, Karlsbad water, and rinsing of the stomach will be found most satisfactory.

Reichmann washes the stomach with a 1 to 2 pro mille solution of silver nitrate.

Talma and A. Pick described under the name of "acid hyperesthesia of the stomach" a certain morbid condition in which pain is found similar to that in hyperchlorhydria. After the ingestion of acid in general, or of certain acids, also of foods and liquids containing acids in a concentration which do not produce any disagreeable sensations in healthy persons, severe pain arises in the epigastrium. Such patients complain of heart-burn two hours after eating, which may be temporarily relieved by alkalies, as in hyperchlorhydria. However, in the stomach contents no increase of HCl can be found.

There exists an hyperesthesia against certain fatty acids. Some persons tolerate certain fats well, but after the ingestion of other fats, pyrosis, rancid eructations, and gastralgia occur within a few hours.

Catarrh of the Stomach; Atony of the Stomach.—Acute and chronic gastritis as well as motor insufficiency produce a sensation of fulness and tension in the stomach, but only rarely a severe gastralgia.

Gastroptosis.—In gastroptosis pain is rare, usually following overfilling of the stomach. It is usually not severe, and can be relieved by a binder. Sometimes a "mast-cure" will improve the condition. It is advantageous to have the patient recline a great deal, especially after meals. The complaint often disappears during pregnancy, but returns after delivery. That corsets have to be abandoned in such cases goes without saying.

Ulcer of the Stomach.—The pain in gastric ulcer is very characteristic. It occurs in attacks, usually at the height of digestion, is definitely localized, and is very much influenced by the quality of the food. If the pain is continual, we have to think of a complication, peritoneal irritation, spreading of the ulcerative process to the neighboring organs, or of adhesions. In the latter case the pain is less dependent on the quality of the food than on the degree of filling of the stomach and certain positions. Also in uncomplicated ulcer, the pain after ingestion may be dependent on the position. According to Lauder-Brunton, the pain becomes more violent in a third of the cases if on certain positions of the patient the food lies on the ulcer; it is, however, relieved on a change of position. Not only pressure of ingesta, but also peristalsis and the gastric acids whose secretion is stimulated by the food are factors in the irritation. The maximum of pain, therefore, is not usually found immediately after ingestion, but one hour later, when a considerable amount of fresh acid is present and the peristalsis is vigorous. In some cases of ulcer where hypersecretion is predominant in the picture, ingestion in appropriate form, as milk, relieves the pain, since the acid is fixed at least for a short time.

The character of the pain in gastric ulcer is variously described. Sometimes as burning, pungent, or colicky, at other times it radiates into the thorax, arms, and along the vertebral column. By pressure from without it is constantly increased and therefore no corset can be tolerated where an ulcer develops.

The constant tenderness of certain points in the epigastrium is of value for the diagnosis of gastric ulcer. By knocking on the lower part of the thorax with the fist, in its left posterior part at the height of the margin of the lungs and below, increased sensibility to pain may be produced, as determined by comparison with the right side. In ulcerations of the lesser curvature, retrosternal irradiations of pain may be observed, which usually extend only to the lower part of the sternum, sometimes, however, extending to the neck, in which case they may give rise to confusion in diagnosis with angina pectoris,

associated with a feeling of oppression and produced by exercise (Rudolph Schmidt). If we suspect a gastric ulcer from the character of the pain, we will put the patient on an appropriate diet. In this way we may confirm our diagnosis, if the pain is relieved after some time. Otherwise, as v. Leube states, we have no right to think of beginning scar formation and to blame the scar for the pain. Scars are usually not sensitive to pressure; points where this sensitiveness exists speak for ulcers which are still active, and the spot where the pain on pressure as definitely localized coincides usually with the maximum of spontaneous pain, though this radiates in different directions. The time at which the pain appears and the position by which the patient prefers to relieve himself allow us to draw conclusions as to the location of the ulcer. If it sits on the cardia, the pain is sometimes increased at once after the act of swallowing.

Scars after Gastric Ulcer.—Scar formation after gastric ulcer may cause considerable discomfort. The constant absence of blood in the stools will help in the difficult differential diagnosis from an active ulcer. The treatment consists in the subcutaneous injection of thiosinamin (1 c.c. of a 20 per cent. solution), and in surgical intervention.

In hysteria a symptom-complex is sometimes found which resembles gastric ulcer exceedingly, and therefore has been designated by A. Pick as "pseudoulcer."

Pseudoulcer.—The following factors important for the differential diagnosis between the round gastric ulcer and this form of hyperesthesia are taken from his paper on "Sensory Neuroses of the Stomach:"

1. Liquids are tolerated as poorly or worse than solid food, in contrast to gastric ulcer in which liquids produce less pain, as a rule.

2. The hyperesthesia may occur in attacks of varying duration, between which periods of complete well-being exist. The patients may tolerate even difficultly digestible foods.

3. The points of pressure do not lie to the left of the spinous processes of the lower thoracic vertebræ, but higher up on the vertebral column itself, often between the scapulæ to the right or left of the spine.

4. The pain in pseudoulcer is relieved by faradization, but increased in gastric ulcer.

The general condition of the patient is little disturbed in pseudoulcer. His strength is relatively good, which stands in conspicuous contrast with the severe subjective manifestations.

Carcinoma of the Stomach.—In cancer of the stomach, a course completely free from pain is found only exceptionally. Rudolph Schmidt points out that in the initial stage of cancer a pain may sometimes be present, which is caused probably by the fact that in

the greater number of cases the carcinoma develops near the pylorus, and that it may give rise to disturbance of passage at the pyloric end, which in the beginning may be of spastic nature. The pylorus stenosis due to carcinoma proceeds, according to this author, with less intense attacks of spontaneous pain than the benign form of stenosis. Dull pains are usually complained of which are felt most intensely at the *locus* of the carcinoma. If the pain is excessive, we have to think of peritoneal irritation. The pain in carcinoma of the stomach appears generally at a longer period after the meals than in ulcus ventriculi; only cancer localized on the cardia forms an exception to this rule.

Cardialgia from Diseases of the Vessels.—According to Kaufmann and Pauli, a diseased condition of the vessels must be thought of if the patient complains of pain in the umbilical and epigastric regions. The pain is dependent on the quantity, but not on the quality of the food taken in. A sensation of anxiety exists, reminding one of stenocardial attacks, and the abdominal aorta is sensitive to pressure.

Sodium iodid and diuretin should be administered, but no digitalis.

Nervous Cardialgia.—We have finally to consider nervous cardialgia which announces itself by a hyperesthesia against certain foods, as sugar and fats, after whose ingestion pain occurs. This disturbance is sometimes found after influenza (Fürbringer). The sensitiveness of the stomach to percussion is occasionally very pronounced, so that it is possible to determine the borders of the stomach by this means. This behavior will also be found in common gastritis. Severe attacks of pain arise sometimes, in which the patient presses the fist against the stomach or presses his stomach against a hard object.

Beside the acid hyperesthesia which has been mentioned, we distinguish a mechanical and thermic hyperesthesia. In the latter violent pain is produced by too warm or too cold foods.

It is interesting in this connection that those foods for which a hyperesthesia exists, cause discomfort even if they are mixed with the food of the patient without his knowledge and without his recognizing them during eating (v. Fleiner).

Pain in the transverse colon may sometimes be mistaken for gastralgia, a mistake readily understood if we consider the topographic position of the organs (Trousseau).

We will think of nervous gastralgia, then, only if no anatomical disorder, not even hypersecretion of gastric juice, is present. This pure nervous gastralgia we find occasionally in chlorosis, in anemia, in uric acid arthritis, malaria, on pressure of the sympathetic vagus by a tumor, in the course of a myelitis, multiple sclerosis, Graves' disease, or in disorders of the male and female sexual organs, especially

as a symptom associated with, or taking the place of, menses. Fliess states that only the last-mentioned form of cardialgia may be relieved by cocainization of the turbinates, but not that appearing in the course of tabes, hysteria, or chlorosis. In diagnosing these forms, not only every disease of the stomach, but rheumatism of the abdominal musculature, intercostal neuralgia, gall-stone, and renal colic, as well as hernia of the linea alba, must be excluded.

A quite useful remedy against these nervous cardialgias is a 2 to 3 pro mille solution of silver nitrate, given in doses of 1 tablespoonful in a wineglass of water, one-half hour before eating (Rosenheim).

Finally, we may mention the very frequent occurrence of gastralgia in the onset of eclampsia, which is as yet entirely unexplained. If in a pregnant woman in the last weeks, gastric pain and headache appear, one must always think of the possibility of a threatening eclampsia. The gastralgia may be caused by the excretion of a toxic gastric product into the gastric mucosa, which first causes pain and later on vomiting.

The gastric crises of tabes will be taken up in connection with the intestinal crises.

Intestinal Colic

The intestine is very frequently the seat of pain; this fact has been the cause of many theoretical discussions, since, in the course of operations without general anesthesia, just the intestines proved entirely painless. Intestinal operations have been performed under local anesthesia and it was then found that the parietal peritoneum is very sensitive, whereas the visceral peritoneum may be cut through without causing any sensation of pain. From this the conclusion was drawn that affections of the intestines and also of the stomach give rise to pain only when they have led to irritation of the parietal peritoneum.

In discordance with this opinion are the experiences which are gained from symptoms of ordinary colic, as Nothnagel emphasized in a lecture on colicky pain. The normal peristalsis of the intestines is not felt, except in the course of hysteria or neurasthenia, in which conditions those organ sensations which normally do not pass over the threshold of consciousness are perceived from the attention given them. Spasmodic contractions are felt as colicky pain, though they certainly are not associated with any irritation of the parietal peritoneum. Nothnagel explains this action of the intestinal tube, in not responding with pain to the most severe mechanical offense, but to the spastic contraction of the musculature, by the assumption that the fibers sensitive to pain are stimulated only by the adequate irritation of contractions and the resulting anemia.

Intestinal colic is usually localized in the upper portion of the abdomen, but may change its localization very rapidly. It is accompanied by meteorism and often ceases immediately after the passage of flatus.

Colicky pain is found:

A. In all inflammatory processes of the intestinal wall and its serous covering.

B. In nervous enteralgia.

C. In the typical colic; *i.e.*, the colicky attack in the stricter sense.

Inflammatory Ulcer of the Intestine.—The intestinal mucosa may be the seat of ulceration which may pursue a course without symptoms, even without pain. In other cases the patient feels an exactly localized pungent pain at the point of ulceration, feeling like a wound, or a definitely localized sensitiveness on pressure. These factors will always draw our attention to the possible presence of ulcer. When the ulcer has become cicatrized, causing a stenosis of the intestinal lumen, other forms of pain may arise. Colicky pain caused by the pressing of the intestinal contents through the constricted portion is usually associated with rigidity of the intestines (Darmsteifung), which may be directly seen, and disappears with gurgling the moment the intestinal contents pass the stenosis.

Intestinal Catarrh.—In intestinal catarrh no continuous violent pain is present, but a diffused sensation of tension and occasionally colicky pain.

Dysentery.—Severer discomfort, followed by a tormenting tenesmus, is found in all forms of dysentery. The colicky pain appears even on the first day, the tenesmus when the stools become of thin, characteristic quality.

The treatment of pain in the course of affections of the intestinal mucosa coincides, of course, with the treatment of the primary disease, but in severe pain the use of opium, 0.02 to 0.03 gm. two or three times a day, may be justified. Injections of morphin should be dispensed with, as opium, given internally or in the form of suppositories, usually acts very readily.

Here belongs, according to some authors, the primary stercoral sigmoiditis and perityphlitis, diseases whose primary existence Nothnagel denies.

Ewald believes that sigmoiditis may develop as a primary catarrhal affection of the sigmoid, as a condition ascending from the rectum, or as a diffuse enteritis; that it leads to thickening of the walls and even to formation of strictures; it may be distinguished by rectoscopic examination from carcinoma.

Nervous Enteralgia.—The diagnosis of pure nervous enteralgia is only possible *per exclusionem*. As in the colicky attacks, pressure

decreases the pain. This symptom, therefore, is not characteristic of nervous enteralgia. It is often mistaken for colic due to inappropriate diet, for helminthiasis and organic intestinal diseases, accompanied by colicky attacks. Often hyperesthesia of the skin on the abdomen may be present so that pressure on the skin pinched up in a fold is intensely painful.

Nervous enteralgia may take a chronic course; then it offers not only great diagnostic difficulties, but therapeutically is very difficult to approach. A sojourn in the country, cold-water treatment, faradization, massage, gymnastics, and a varying diet will be the best measures against the neurasthenia and intestinal atony. The hot springs will render good service in some cases.

Romberg aimed to divide this condition into two groups: the hypogastric neuralgias (hyperesthesia plexus hypogastrici), and the celiac neuralgia (hyperesthesia plexus solaris).

In the first group the patient complains of pain in the hypogastric region extending to the sacrum, or of pressure in the region of the rectum, in the bladder, and in women in the genitals. Sometimes irradiation into the thigh is present. In women, malposition of the uterus may be simulated. Occasionally hemorrhoidal colic with or without hemorrhoids may be observed.

Among the nervous enteralgias we may also class those caused by parasites, though in such cases it is not only a reflex condition of pain, but at the same time a mechanical irritation with which we have to deal. Thus Kuttner relates a case of pseudoappendicitis in which oxyures were found in the vermiform process. Nervous enteralgia is not observed in childhood. It occurs in women sometimes with menstruation, and may be repeated at each period. The lumbar part of the spinal cord is also involved in this condition, recognized by the pain in the lumbar region. The treatment consists in half-baths, galvanization of the abdominal wall, faradization, and massage.

In hyperesthesia of the solar plexus we find pain in the stomach, irradiating toward the chest and back, sometimes so violent in character that syncope is produced.

During the attack, injections of morphin and opium suppositories will be our therapeutical measures. Relapse may often be prevented by a continued medication with arsenic (Nothnagel).

In some cases, especially when sensations of annihilation are very pronounced, we may have to deal with a form of angina pectoris whose frequent confusion with attacks of abdominal pain, for instance, gall-stone colic, has been pointed out by v. Neusser. During these attacks of pain, gout and malaria must, too, be considered in the differential diagnosis.

Hysteria.—Hysteria leads to tenderness of the abdomen and

to spontaneous visceralgias. The abdominal points of tenderness, especially, have obtained a certain notoriety as diagnostic points, especially ovarialgia. This term is incorrect not only because the same symptom is found in men, but also because the point does not correspond to the ovaries in women. In general ovarialgia is found more frequently on the left side than on the right. Hysterical persons may cause us some diagnostic doubts by simulating a tumor by a tonic spasm of the abdominal muscles, at the point indicated as painful ("phantom tumor," Binswanger); this disappears at once under chloroform anesthesia or as soon as the attention of the patient is completely distracted.

Visceralgia in the hysteria of childhood is interesting. Children often complain of epigastric pain, during which they bend and press their folded arms against the abdomen to relieve the pain. In the interval between the attacks they feel entirely well. This condition is not due to hypersensitiveness of the abdominal organs to the sharp margins of the recti muscles in diastasis, since diastasis of the recti is found in 75 per cent. of all children in the first years of life; rather, as Friedjung explains, we have to deal with a typical form of hysteria in children. The good results which Büdinger accomplished with an adhesive-plaster bandage are probably brought about by suggestion, and not mechanically. The lumbar abdominal neuralgia will scarcely be mistaken for an intraabdominal condition as we find Valleix's "pointes douloureux."

Rheumatism of the Abdominal Muscles.—Rheumatism of the abdominal muscles is characterized by a high degree of pain on movement, as sitting up or defecation. The sensitiveness to pressure is slight and on absolute rest no pain is present.

In childhood an epigastric pain is found in rheumatism, which responds promptly to the use of salicylates (Pearion).

Hernia of the Linea Alba.—Cardialgia and enteralgia are frequent in hernia of the linea alba; the hernia usually contains only subserous fat or omentum and causes severe pain on bending and after ingestion, so that in many cases operation becomes necessary. Often it is sufficient to replace the hernia and to prevent its reappearance by the application of a truss.

Flatulent Colic.—The most common form of enteralgia is the flatulent colic, produced by irritation from an increased amount of gas in the intestines. It is increased in processes of excessive putrefaction or of abnormal lactic acid or butyric acid fermentation. The gaseous products of putrefaction are CO_2, H_2, NH_3, and H_2S; those of fermentation are CO_2, H_2, and CH_3. It is not always an increased formation of gaseous products that is necessary to produce flatulence. It may develop from a hindered removal of the gas

per rectum, as in constipation and in all forms of intestinal stenosis and occlusion. The colic is of special violence in these cases, not only owing to irritation from the gas, but to the attempt on the part of the intestine to remove its total contents.

Increased peristalsis may also lead to flatulency if the intestinal contents reach the large intestine too early, before a sufficient quantity of fermentable matter has been resorbed, thus furnishing too good a medium for the processes of putrefaction.

Decreased resorption of gas may be another cause of flatulency. The carbon dioxid and sulphuretted hydrogen may leave the intestine, not as flatus, but may be resorbed and excreted from the blood through the lungs. In some cases Nothnagel suspected that CO_2 was set free from the blood into the intestinal lumen, and that this secretion of gas into the intestine was a direct cause of flatulency. For there is no other way to explain the sudden flatulency which follows mental emotion than by sudden vasomotor changes of the intestinal vessels.

Swallowing of air is certainly a factor in abnormal gas contents of the intestine. Magendie first called attention to the fact that an inflation of the stomach may be produced by swallowing air. Nothnagel does not believe that this is a cause of intestinal inflation, and, like Valentine, sees the cause in paralysis of the intestinal musculature. A. Pick, however, believes that in certain cases the swallowing of air may lead to distention of the intestines, namely, in those cases where on an hysterical basis an insufficient closure of the pylorus has developed. For it occurred repeatedly that, on the attempt to inflate the stomach for diagnostic purposes, the contour of the stomach disappeared suddenly, the air passing through the pylorus into the intestine. More of this in the chapter on Meteorism. Here it may still be mentioned that colic is produced only by tonic contraction, and not by stretching or violent peristalsis of the intestine. One observes repeatedly that intense peristalsis (borborygmii) occurs without any painful subjective sensations, and that in profuse diarrhea, where the food appears in the stools an hour after its ingestion, there is no colicky pain.

In general, colic is conditioned by different causes. It occurs from the irritation of abdominal ingesta, whether from its quality (young, unfermented beer, new wine), or temperature (too cold); from a too abundant amount of mucus in the intestine (colica mucosa); from the presence of tape-worms and ascarides; also in constipation and in catarrhal processes of the intestinal mucosa, and after the injurious effects of a cold; whether these latter rheumatic effects produce colic as a purely reflex pain or by a slight catarrh or simple hyperemia cannot be decided here.

At the onset of perityphlitis colic is frequently met with, due to

the contractions of the appendix. In slight relapses of appendicitis colicky pains may arise from time to time, lasting only a few hours, but without any increase of temperature. All transitions exist from this to the most severe forms of perityphlitis. There are still no reliable symptoms from which one may judge of the course of this condition. The same complaint is met with in the hysterical pseudoappendicitis and following operation on the cecum as a result of adhesions. This whole question, so important for the treatment of appendicular affections, cannot be ventilated here.

Since the differential diagnosis between cardialgia and enteralgia is often very difficult or impossible, we will take up their therapeutical measures together.

Treatment of Enteralgia in General.—The treatment of gastralgia and enteralgia will depend in the first place on the primary disease. For the nervous form of gastralgia, aqua chloroform and aqua destill., āā 1 tablespoonful three times a day, cocain hydrochlorate. 0.03 gm. per dose or antipyrin may be tried. Leube recommended galvanization, applying the anode on the stomach for five to ten minutes; Leser, faradization of the abdomen; codein, opium, and morphin, in subcutaneous injections, will be of beneficial action in severe cases. Warm douches on the abdomen at 38° to 44° C., or carbon dioxid douches from a siphon often give excellent results in cardialgia.

Also in enteralgia the application of heat is of excellent symptomatic effect, whether by hot wet towels or by the thermophore. An abdominal bandage may sometimes prevent the recurrence of abdominal attacks in persons predisposed. A Priessnitz compress often renders good service.

If an abnormal production of gas and fermentation processes are suspected, ammonium sulphoichthyolicum, in pills of 0.1 gm. 1 to 3 pills three times a day, and creosote, in 0.5 gm. doses, are of beneficial action. Creosote must be given with food, as otherwise it causes digestive disturbances.

Large doses of calomel (0.3 gm.) cause sometimes a prompt disappearance of the colic in adults.

In a beginning perityphlitis, laxatives are strongly contraindicated. Opium may be given to allay the pain.

If parasites are present, their expulsion by appropriate remedies will free the patients of the colicky pains.

Tumors.—Malignant tumors may produce continuous, well localized pain; but they also lead to colicky pain, if they have led to considerable stenosis and hypertrophy in the portion of the intestine above the tumor. Severe continual pain and tenderness will arouse the suspicion of peritoneal irritation. Carcinoma of the rectum will be discussed in the chapter on Tenesmus.

Pediatric Aspect.—Abdominal pain is of frequent occurrence in infancy.

Flatulent Colic in Infants.—Flatulent colic especially is met with daily in infants. Inflation of the intestine and the colicky pain resulting from it are the most frequent cause of the uninterrupted crying of infants. The abdomen is hard and protruding, the diaphragm stands high, the thighs are drawn up on the abdomen; the child quiets down at once if it is placed on its abdomen, with the application of warm compresses or massage. The many tea infusions of carminative action so much in favor in the nurse-room are not advisable, since the large quantity of liquid in which they are given only harms the stomach and intestines. Another practice which cannot be enough criticised is the use of the enema syringe every time the child cries. The manipulation, at times done somewhat roughly, only helps to relax the lower intestinal parts. The etiological factor must never be neglected in the treatment of infantile colic.

In breast-fed children, overfeeding is its common cause. The breast is given the child as a sedative, and because the children are at once quiet the mother concludes that the baby has only cried from hunger, whereas it only forgot its pain in the act of nursing. After ingestion the pain increases the more as well as the crying.

In these cases one will accomplish results only if the breast is not given for half a day; instead, weak tea is given, and, at intervals of three hours, two powders of calomel each containing 0.01 gm.

On resuming the breast feeding, regular intervals of three or even four hours must be strictly observed. In order the more readily to induce the mothers to follow this measure, which seems to them Draconian, Monti advises combining it with a sedative mixture:

Rp.	Natr. benzoic.,	1.0 : 90.0
	Tinct. opii,	gtt 1.0
	Syrup. simpl.,	10.0

Another useful medication is the following:

Rp.	Aqu. menthæ pip.,		
	Aqu. fœniculi.,		
	Aqua carminativ.,	āā	15.0
	Aqu. destill.,	ad	100.0
	Syrup. simpl.,		10.0
	Tinct. laudani,	gtt	ii–iv

Of either prescription a tablespoonful is to be given every two hours.

The use of a so-called "blind enema" is sometimes of benefit, a soft-rubber tube (catheter) is well oiled, introduced high up into the rectum, and while it lies there the abdomen is massaged in the

direction of the hands of a watch. The gas passes and the child calms down.

In other cases the colic results from dyspepsia or intestinal catarrh. Here one will proceed according to the primary disease, but the colic also must be treated, as too long crying may lead to umbilical or inguinal hernia and occasionally to hydrocele. Whether children who cry continually do not thrive from their wasted force is an open question, but certainly one occasionally sees criers who are splendidly developed.

Perityphlitis is rather a rare affection in infants, but must be thought of in severe attacks of pain. Abdominal pain may be due to a tubercular peritonitis whose dry form, with caseous peritoneal glands, may occur at a very early stage of life. If glandular tuberculosis is suspected, a condition in which kinking and constriction occur from adhesions, careful palpation of the abdomen bimanually through the rectum must never be omitted.

Other Enteralgias.—The larvate form of malaria may sometimes appear as severe enteralgia, returning in regular intervals. In these cases we give, a few hours before the expected attack, 1 gm. of quinine; and 1 gm. every day, even one to two weeks after the attacks have ceased.

In the course of uric acid arthritis attacks of severe spasms in the stomach alternate with those of gout; they are not increased by pressure, but rather alleviated. Severe prostration and even collapse are not uncommon features.

Like "gastric gout," the gouty colic of the intestine may arise in the course of arthritis urica, producing a picture similar to lead colic or the crises of tabes.

In severe cases of these gastric and intestinal colics, morphin and warm cataplasms will be our refuge; the diet must be limited, consisting chiefly of thick soups and floury decoctions. After the attack has passed the usual diet for gouty patients must be instituted. Minkowski advises:

Breakfast:	200 gm. tea with sugar; 50 gm. cream; 2 eggs—15 gm. butter; 50 gm. zwieback;
Noon:	300 gm. soup with 30 gm. barley; 150 gm. bread; 100 gm. pike with butter; 30 gm. potatoes; 100 gm. veal; 100 gm. spinach;

30 gm. cheese;
10 gm. butter;
100 gm. fruit;

Evening: 200 gm. milk soup with grits;
100 gm. bread;
20 gm. butter;
75 gm. lean ham;
200 gm. tea with 10 gm. sugar.

Lead Colic.—The recognition of lead colic is of great importance. It is a very tormenting condition, in which the patients writhe with pain. The attack does not usually last longer than a quarter of an hour, but even in the intervals the pain is scarcely completely absent. The abdomen is retracted, due to an enterospasm, caused by the direct action of the lead on the unstriated musculature. Constipation is a constant symptom, the pulse is retarded and of high tension; the temperature usually subnormal, rarely increased. The complete absence of sweating, even in complete collapse is a striking feature.

The diagnosis may be made with complete certainty if the characteristic blue line on the gums is associated with this symptom-complex. Even if the anamnesis does not point to intoxication with lead, the diagnosis made from this symptom will practically always prove correct, provided that, in fact, the blue line is not simulated by some other substance, as, for instance, a black tooth powder. The occupation of the patient is of great help in the diagnosis, as people who handle lead-carrying substances are frequently subject to this disease; thus varnishers, printers, and numerous other workmen are exposed, and only a thorough knowledge of the various kinds of work in which lead is used will prevent diagnostic errors. The introduction of hygienic measures into these occupations has considerably decreased the frequency of the condition in latter years.

Mannaberg reports a case of lead intoxication by paprica which was colored by (Pb_3O_4) the red hypooxide of lead.

The treatment consists, first, in the use of opium and protracted lukewarm baths. Belladonna preparations and scopolamin will occasionally be relied upon, though in general these preparations may be dispensed with. After the attack of colic has passed, we must aim to remove the lead from the organism by giving sodium iodid. In the attack itself cathartics are without value; especially the salines, which to a certain degree have the value of an antidote in acute lead intoxication, are here contraindicated, according to v. Jaksch's opinion. Irrigations with oil are the most appropriate measures for moving the bowels.

Pain in the Liver

The parenchyma of the liver is entirely anesthetic, and processes developing slowly in it may produce no sensations of pain, even if they cause extensive destruction. Only when the serosa or the biliary passages are involved is pain felt. Pain is therefore present in any condition which stretches the liver capsule. The patient complains of pain of varying severity, increased on movement and deep inspiration, and usually radiating into the right shoulder. This latter symptom must probably be explained by involvement of the right phrenic nerve, which sends fibers through the diaphragm into the suspensory ligament of the liver, and by the extension of the irritation to the neighboring ganglion cell groups which have connections with the shoulder nerves. This radiation into the right shoulder is not observed in the pain of perityphlitis. The left lateral position increases the pain in the liver capsule, since the suspensory ligament is thereby stretched. The right lateral position, on the other hand, increases the pain in those cases in which the pressure of the liver on the neighboring organs is felt as disagreeable.

Gilbert and Villaret described pain in the liver in asthmatic patients (*hepatalgie des asthmatiques*). The liver in this case is the seat of spontaneous pain, and is also sensitive to pressure, without any pathological condition discoverable, clinically, in liver or heart. Subicteric discoloration and urobilinuria are usually present, caused probably by the congestion in the liver.

In liver abscess, developing frequently in the course of dysentery and rarely in typhoid fever, the patient sometimes complains of beating pain.

If liver abscess is suspected we should proceed antiphlogistically, applying an ice-bag to the hepatic region and brushing the skin with iodin tincture. Other derivative methods, as the appliance of cupping glasses, etc., are not advisable, as the skin is thereby unfavorably affected previous to the surgical intervention which may become necessary. The internal use of calomel in laxative doses sometimes gives excellent results in this stage of the disease.

If the diagnosis is certain, capillary puncture may be performed if laparotomy is refused. The capillary puncture is performed like an exploratory puncture with the difference that one must aim at the complete removal of the pus. A repetition of the operation will naturally be sometimes necessary. Drainage by puncture is performed by means of a thick trochar which remains in place after the puncture. This is very important: pus may ooze into the abdominal cavity, producing a severe peritonitis. Later on, the trochar may be substituted by a rubber drain pushed through it.

Since any tension on the liver capsule causes pain it occurs in active and passive hyperemia of the liver, congestive jaundice, the phosphorus liver, acute yellow atrophy, and syphilitic hepatitis; further, in carcinoma and abscess of the liver if the volume of the liver is rapidly increased.

In the initial stage of liver cirrhosis pain in the region of the liver is found, especially after heavy meals and an excessive use of alcohol; cold compresses, moderation in eating, and abstinence from alcohol have to be advocated urgently. The pain of the congested liver, produced by weakness of the cardiac muscle is effectually combated by Leiter's cooling apparatus and by treating the compensatory disturbance.

Gall-stone Colic.—Especially violent pain may be incited from the biliary passages. The commonest cause of it is gall-stones. Gall-stone colic develops with a sudden onset of violent pain, usually localized in the region of the gall-bladder, frequently, however, over the stomach. At the same time there is tenderness over the gall-bladder, which may be enlarged and palpable. In the greater number of cases jaundice is not present. The temperature is sometimes normal, at others increased; chills and collapse are not infrequent during the attack.

The differential diagnosis is sometimes exceedingly difficult. Duodenal ulcers especially sometimes proceed with the picture of cholelithiasis. The intervals free from pain, sometimes quite long, and the fact that during these periods even coarse food is well tolerated, when considered in connection with the symptoms previously mentioned, speak in favor of the diagnosis of gall-stone colic.

A great number of the so-called gastralgias are caused by gall-stones. The colic is, further, frequently confused with inflammation of the appendix. The increased tenderness toward the costal arch and its decrease downward speak for cholelithiasis. If gall-stone colic is associated with vomiting, meteorism, constipation, and an excessive sensitiveness to pressure it may simulate an acute ileus.

The treatment must aim to check the pain of the attack and, on the other hand, to remove the primary condition. Some authors believe that the formation of gall-stones may be prevented if biliary engorgement can be prevented, and therefore forbid the wearing of tight garments, for instance, corsets or belts, that could lead to this condition; the regulation of the bowels by mild laxatives is also said to have a prophylactic action.

Of importance for the pathogenesis of cholelithiasis is certainly insufficiency of the liver. This may be produced in the following way: the quantity of putrefaction products formed in the intestines and reaching the liver through the portal vein exceeds a certain

physiological limit. Since animal food gives rise much more readily to putrefaction, a chiefly vegetable diet would be an appropriate measure, according to this conception, in preventing liver insufficiency and its sequelæ. Naunyn considers a mixed diet the best cholagogue.

Regarding the treatment of the gall-stone attack, the first thing for the patient to do is to remain in bed. Hot, wet, compresses, with a thermophore between the wet compress and a dry towel, in some cases seem to alleviate the pain. Instead of the thermophore, a sack of warm salt or of warm sand may be used. Though heat is very useful in the greatest number of cases, there certainly are cases in which cold is better tolerated. In our decision we are best directed by the feeling of the patient, since either warm or cold compresses are beneficial, according to an old saying, as long as they produce the sensation of well-being. Irrigations of warm water or of warm camomile tea will act to a certain degree as an anodyne and at the same time will exert a successful action on the constipation so frequently existing in cholelithiasis. During the attack the diet must be chiefly liquid. We give soup, milk, tea, and, later, floury decoctions and purées. The more pronounced the inflammatory processes of the gall-bladder, the more careful must we be with the diet.

If the pain is not too severe, Durand's remedy may be tried. It consisted originally of equal parts of ether and turpentine, of which 20 to 30 drops were given three to four times a day. Durand himself, later changed the prescription, giving 3 to 5 parts of ether to 1 part of turpentine in one dose. Dupareque gives 1 part of ether and 60 parts of castor oil with very good success, as he states. An excellent remedy is the sodium salicylate recommended by Stiller, which is given in 0.5 gm. doses, with the same amount of bicarbonate of soda four times a day, dissolved in water. Naunyn also recommends sodium salicylate.

American physicians introduced the treatment with large doses of olive oil, which, given in the doses of 250 c.c. every morning, is said to be an excellent cholagogue. Rosenberg reports good results from it. The treatment at watering-places as Karlsbad, Vichy, Neuenahr, etc., is sometimes successful; Leichtenstern, however, places the chief weight on the changed mode of life in these places, and demands that the water be drunk in large quantities, if it is to have any effect.

If the attack is very violent, a morphin injection cannot be avoided. It has not only an exceeding beneficial effect on the tormenting pain, but it fulfils still two other indications. It relieves the spasm, occasionally permitting the stone to pass into the duodenum; and prevents ulcerations and scar formations with their farther consequences by freeing the stone from its vice. Chloral hydrate is of little effect, since it acts more as an hypnotic than as a

sedative. Others give chloroform, 3 to 6 drops in a little ice water, and even general anesthesia has been tried. Swift-Walker recommend hot baths and hot drinks. Quisling wraps up the hypogastrium above the liver with a Martin's bandage, reporting success from it; but this measure will scarcely be feasible in violent pain. Local blood-letting is said to relieve in some cases. If one wishes, with Trousseau and Sticker, to give belladonna preparations with the aim of relaxing the spasm, one must proceed with heroic doses, watching the patient constantly to perceive the first signs of intoxication.

If collapse has developed, energetic measures must be adopted.

Massage and electricity have also been advised in the treatment of cholelithiasis, but they can scarcely be used during the severe pain of an attack.

Other dangerous conditions may develop as sequelæ of cholelithiasis such as cholecystitis, cholangitis, pericholecystitis adhesiva or purulenta, pylephlebitis, and phlegmonous processes, which may only be avoided by the rapid removal of the incarceration, or by the early energetic use of morphin.

If there are symptoms of abscess of the gall-bladder (repeated chills, continual fever) surgical intervention has to be considered, though it must be conceded that single chills may occur in gall-stone colic in complete absence of empyema of the gall-bladder.

If a gall-stone disease cannot be reached by medicinal and dietetic treatment and by repeated treatments at watering-places, or if the stones have accumulated in the gall-bladder, whence voluntary passage cannot be expected, operation alone can relieve the patient from his suffering.

Gall-stone colic is very often not recognized, and in some cases it is simulated by other diseases. Not every gall-stone colic need be associated with jaundice; this follows logically from the theoretical reflection that the cystic duct may be the seat of the obstruction, as is frequently the case. On the other hand, attacks of jaundice may develop without any attacks of pain, though very rarely, from obturation of the common bile duct by gall-stones.

Liver Crises.—Other processes which often cause errors in diagnosis are the hepatic crises of tabes, probably due to a spasm of the bile duct, leading to violent colicky pain, and occasionally to a slight jaundice. Angina pectoris may sometimes simulate an attack of cholelithiasis, the more, as, after an attack has passed, a slight jaundice may occur (v. Neusser). Fürbringer speaks of a liver neuralgia which he calls a pseudo-gall-stone colic, in which the absence of jaundice and of liver swelling and of the inflammatory manifestations always associated with gall-stone colic allow us to exclude this condition.

Pancreatic Stone.—Pancreas stones, if impacted in the duct of

Wirsung very near the papilla Vateri, may, by compression of the common bile duct, lead to jaundice. The diagnosis of this pancreatic-stone colic is scarcely possible; it may be suspected if fatty stools, with insufficient splitting of fat, are found after the colicky attack.

Sometimes patients, especially children, complain of pain in the region of the liver. On closer examination we find swelling of the liver and spleen, and a peculiar dyspnea and cyanosis which we are unable to explain. In this symptom-complex, adhesive pericarditis must be thought of.

Pain in the Spleen

The action of the spleen in its different morbid conditions is a very changing one. In movable spleen often no discomfort is present, and the diagnosis is an accident. In other cases, it causes violent pain, localized in the epigastric region, or radiating into the left shoulder or left thigh. The discomfort is occasionally so severe that all methods of palliative treatment, consisting in bandages and other measures directed against the enteroptosis, must be relinquished, and the fixation of the spleen by splenopexis must be performed (Rydygier).

The acute inflammation of the splenic capsule, perisplenitis, may cause very violent pain which increases with the inspiratory movements, similar to diaphragmatic pleurisy. Derivations to the skin by warm cataplasms, by sinapisms, or by cupping glasses must be tried.

If, in the course of an endocarditis, embolism of the spleen occurs with infarct formation, sudden high fever or a chill will announce the condition. At the moment the embolus occurs the patient feels a violent pain. The spleen is occasionally found enlarged.

Of the abscesses of the spleen which also are usually due to emboli, the chronic take a painless course, while the acute cause severe pain. If the diagnosis can be made, which is very rarely the case, surgical treatment of the abscess is necessary.

Whereas the engorged liver is usually very sensitive to pressure, the engorged spleen, especially if gradually developed, is free from pain.

Acute splenic tumors, as the acute enlargement of the spleen in typhoid fever, are accompanied by a moderate, but constant sensitiveness to pressure.

Rupture of the spleen may, in rare cases, occur as a result of trauma in the normal spleen, usually as a result of it in the pathologically changed organ. In this case the trauma may be a very slight one, indeed not to be demonstrated in some cases. Rupture of the spleen causes very violent pain localized in the splenic region. Laceration of the spleen has been observed also in severe attacks of

malaria. The danger of rupture of the spleen lies in the internal hemorrhage, whose symptoms announce themselves very rapidly.

Pain in the Kidney

Inflammatory Affections.—Inflammatory processes of the kidney are only in the rarest cases accompanied by severe pain, but sometimes in acute nephritis, especially at the time of the onset, pain in the region of the kidney is complained of; it seldom attains a considerable degree and responds promptly to local counterirritation of the skin by the measures mentioned above.

Kidney Infarct.—Renal infarct is announced by a sudden violent pain in the kidney region. Traube relates a case in which the pain, localized over the kidney, radiated into the thigh of the same side, thus pointing out on which side the infarct had formed. Hematuria following the attack is a symptom essential to the diagnosis.

Renal Colic.—In the clinical picture of nephrolithiasis pain predominates; the presence of stone in the renal pelvis sometimes causes pain before the stone has moved or become incarcerated, especially on concussion of the body, as in horseback riding, in driving on a rough road, etc. Pain, which does not have the character of renal colic, may develop if small concrements, in the form of gravel, pass, irritating the mucous membrane of the renal pelvis (pyelitis calculosa); this is often combined with the passage of blood, mucus, and pus.

If a disturbance of passage arises during the progress of a stone through the ureter, a colicky attack is incited, with violent dragging pains in the direction of the ureters and radiating into the testicles or thighs. Reflexly, tormenting strangury develops, and only a few drops of urine, often bloody and rich in sediment, are secreted. Severe general manifestations, collapse, cold sweats, vomiting, a weak pulse, and chills may be present. Complete well-being and polyuria usually follow the passage of the stone.

In cases in which the other kidney is insufficient, uremia may develop by the impaction of a stone on one side as well as in those exceptional cases where stones are impacted in both ureters. Sometimes the other kidney may, purely by reflex, become insufficient.

A further danger of renal colic consists in the possible rupture of the ureter with subsequent peritonitis. Perforation of the stones into the intestine or toward the surface are exceedingly rare, though repeatedly observed.

Renal colic may reflexly lead to paralytic ileus; in other cases it may simulate a severe enteralgia.

Regarding the treatment of nephrolithiasis, we will, as a prophy-

lactic measure, restrict meat, and prescribe the use of mineral waters in all persons in whom the tendency to the formation of concrements exists. The great solubility of lithium urate has, on theoretical grounds, led to the use of lithia waters, and to the use of lithium carbonate, which is given in doses of 1 gm. *pro die* in large quantities of mineral water. Also piperazin, 1 to 2 gm. daily in 1 liter of Selter's water, is believed to increase the solubility of the uric acids. Urotropin (hexamethylentetramin) is very much recommended. It is given in 0.5 gm. doses three times a day. It is believed not only to dissolve the uric acid, but in an effectual way to act against possible infections by setting free formalin. Lycetol, a derivative of piperazin, given in doses of 1 gm., and lysidin (methylglycoxalidin) in doses of 0.25 gm., may in some cases be of value.

Similar to our treatment of urate concrements will be that of oxalate stones. If we have cause to suspect phosphate concrements, we will aim to increase the acidity of the urine. We will, therefore, not give alkaline carbonic acid waters, but simple carbonic acid waters, HCl, or lactic acid, and a diet rich in carbohydrates. Senator states rightly that we are scarcely able to produce an excretion of so large a quantity of acid that the solubility of phosphate is increased to any considerable extent, and we will therefore aim to increase the solubility by a very abundant diuresis.

If a severe attack of renal colic has once begun, one will give an injection of morphin without being too modest in the dose. Besides, hot compresses on the abdomen, hot baths, and large irrigations of luke-warm water, with the addition of 20 drops of opium, will be of good service. For coexisting anuria, an abundant supply of water, thirst enemas, and injections of physiological salt solution must be tried in order to stimulate diuresis, and to remove the impacted stone by *vis a tergo*. Careful stroking massage along the ureter toward the bladder accomplishes removal of the stone in rare cases. J. Israel advises not to wait longer than two days, even if the discomfort of the patient is not very considerable, and then to proceed along surgical lines. This will also be indicated where the patient is tormented with too frequent attacks of colic and hematuria, or if the anuria is frequently repeated. The operations to be considered are the nephrolithotomy, consisting in the opening of the renal pelvis and extracting the stones; nephrotomy, indicated in cases in which severe pyelitis is present; and nephrectomy if the renal substance is so injured that the maintenance of life is dependent anyway on the function of the other kidney.

Movable Kidney.—Movable kidney causes only slight discomfort usually; often the observation of the patient, imbued with hypochondrial ideas, will be the cause of attention being first directed to it.

It is, therefore, in many cases not advisable to call the attention of a nervous patient to a movable kidney. If the movable kidney becomes incarcerated, then the symptoms may assume a threatening character. Violent pain, nausea, anxiety, and chills are the chief manifestations of the incarceration which leads, reflexly, to cessation of the urinary secretion, sometimes to a transient albuminuria.

The prophylactic treatment has to care for good hygiene during pregnancy and the puerperium. Women should not be allowed to get up after labor until their abdominal walls have again reached a certain adequate tonus.

If incarceration of the movable kidney becomes frequent, nephropexis will have to be performed (Küster, Morris). In the presence of incarceration, one must not aggravate the condition by fruitless attempts at reduction, but try to bring relief by absolute rest in bed, small diet, warm baths, administration of morphin, and by the application of an ice-bag at the point of severest pain. The incarceration may usually be prevented by a well-fitting bandage, which supports the abdominal organs, especially the stomach. The action of this bandage may be controlled by the X-ray picture, whereby the replacement of the stomach in its normal position permits us to infer a favorable influence on the other abdominal organs.

Renal Neuralgia.—There exist severe renal neuralgias as the "crises nephritiques," or "renales" described by Raynaud and Lereboullet. They resemble renal colic entirely.

Occasionally the so-called "idiopathic" ureteral and renal colics are observed, sometimes associated with hematuria (néphralgie hematurique, Sabatier). The pathogenesis of this attack is as yet not solved. In some cases, however, it may be a trauma or diseased condition of the ureter, perhaps malaria, which incites these attacks. Johnston sees the cause in a too tight and thick capsule; and therefore decapsulation has been advised to free the kidney from its incarceration in its own capsule. This intervention has led to recovery in some cases. How much is to be ascribed to suggestion has not been decided. At any rate one must first think of renal concrements, and take an X-ray picture.

Kidney Abscess.—In abscesses of the kidney, chills followed by fever, enlargement of the kidney, hematuria or retention, and severe pain in the renal region, usually radiating downward and increased on pressure, are the usual symptoms.

Paranephritic Abscess.—Paranephritic abscesses of whatever nature lead to considerable pain.

Kidney Tumor.—Tumors of the kidney cause pain sometimes, but there will be other symptoms present which will point to the right diagnosis, and the indication for operation will depend chiefly on

those principles which the new doctrine of the functional renal diagnosis has instituted.

Inflammation of Urinary Passages.—Inflammatory affections of the renal pelvis, ureter, and bladder may produce pain in the kidney region, just as do tumor of the bladder and urinary calculi.

Hydronephrosis.—Hydronephrosis, however, causes only little discomfort, unless the condition has developed into a displaced movable kidney. Then violent pain is frequent, conditioned by dragging on the neighboring organs. In those cases in which, after emptying the hydronephrotic sac, a sudden accumulation of liquid takes place, violent pain may arise which resembles renal colic (Renvers).

Acute Cystitis.—Acute cystitis is associated with pain, not only in the bladder region, but higher upward; strangury is present.

Perityphlitis.—It is important to know that perityphlitis is sometimes obscured by the picture of painful retention of urine. The question whether we have to deal with a nervous involvement of the bladder or with a real anatomical lesion may be decided by the examinations of the urine, and in many cases by digital examination of the rectum, since the abscess itself may often be palpated in perityphlitis, or at least suspected by a peculiar edematous condition of the rectal mucosa.

Diseases of the Peritoneum

The excessive pain in peritoneal affections is generally known; the patient cannot even endure the weight of the bed clothes. The picture of the disease, prognosis, and treatment are very different, according to the primary disease, and cannot be discussed here. Only the nature of the pain may be considered.

Diffuse acute peritonitis is one of the most painful diseases. Nothnagel explains this by the fact that a very great number of sensory nerve ends are in a state of excitation at the same time. The patient lies motionless, his breathing being purely costal to prevent any movement of the peritoneal organs by respiration. Defecation and cough are enormously painful, as well as singultus, which often is a source of great torment to the patient.

The continuous pain suffers colicky exacerbations by peristalsis; therefore they are absent if intestinal paralysis has developed. The onset of the pain and its punctum maximum do not always correspond with the point of origin of the diffuse peritonitis. The initial and most severe pain is often referred to the umbilical region, as in appendicitis and incarcerations, but the cause of this localization is unknown.

In circumscribed peritonitis the pain usually corresponds to the affected region.

The spontaneous pain in chronic peritonitis is generally slight. In the chronic tubercular, carcinomatous, and purulent peritonitis of the progressive type, it may be entirely absent for some time, according to Nothnagel. Tenderness will, however, be a constant finding.

Therapeutically, we have, as in ileus, to consider opium, eventually Leiter's cooling apparatus, and, in perityphlitis, local bleeding by cupping glasses in the lumbar region. Above all, however, surgical intervention is demanded.

Diseases of the Female Genital Organs

Pain in woman produced by affections of the genital tract is of special importance, and therefore gynecological examination must never be omitted in any doubtful case.

Gastric Crises

The gastric crises of tabes give rise to the most severe abdominal pain. They consist usually in violent attacks combined with retraction of the abdomen. Occasionally they coincide with the lancinating pain of the extremities. The pain usually begins in the inguinal region, ascends to the epigastrium and radiates into the shoulders. In most cases, however, gastric crises appear under a picture of gastralgia. The patients bend themselves together, throw themselves about from pain, and often moan uninterruptedly for hours. The pulse frequency is increased, the skin on the epigastrium may be hyperesthetic as well as anesthetic, and vomiting may or may not occur. The attack may pass rapidly or last for days, then constituting one of the most tormenting conditions known. A sensation of continual dull pain may exist between the attacks.

The crises of tabes are an early symptom of the disease and therefore frequently are not recognized. This would be very important, as the antisyphilitic treatment gives hope of success only in the first stage of tabes. Leyden, therefore, recommends an energetic treatment with potassium iodid, giving 1 tablespoonful daily for several weeks of a solution of 10 gm. potassium iodid in 300 gm. water.

During the attack itself one can scarcely avoid morphin injections, and rather an effectual dose (0.015 to 0.02 gm.) should be given.

In the course of tabes, the so-called abdominal crises may arise, a severe form of enteralgia, associated occasionally with enterospasms. A physician suffering from these crises observed that the feces produced after the attack had regularly the characteristic quality of stenotic passage (Nothnagel).

B. TENESMUS AND PAIN IN THE RECTUM

General Remarks

Painful straining (tenesmus) is found in diseases of the rectum and the neighboring organs, sometimes also in affections of the higher portions of the intestines (colon) and in nervous diseases.

Tenesmus may exist in diarrhea even if the rectum is empty and no proctitis is present. This behavior has been observed by v. Frankl-Hochwart and Fröhlich also in animal experiment. If the upper part of the intestines is irritated chemically, for instance by acetic acid, a relaxation of the sphincter ani takes place, together with constriction of the intestine.

Proctitis

The affection which most constantly leads to tenesmus is proctitis. It is often caused by the irritation of fecal matter stagnating in the ampullæ recti, farther by coproliths, and by foreign bodies which have got into the rectum. Gonorrhea may be the etiological factor in proctitis, especially in women, in whom the gonorrheal pus easily reaches the anus from the vulva. By taking cold (cold water-closets) an "idiopathic" proctitis is said to be acquired. Farther, proctitis may develop secondarily to ulcerative diseases of the rectum, rectal carcinoma, dysentery, luetic affections of the rectum, tubercular ulcers, and hemorrhoids. It is characterized by tenesmus and pain on defecation. Mucus, blood, and pus are often mixed with the stools. If at the same time there exists an hypertrophy of the prostate or periproctitis, or if an acute prostatitis has developed, dysuria or anuria and sometimes painful erections may arise.

Acute proctitis may heal in one to two weeks. In the chronic form extensive ulcerations of the rectal mucous membrane strictures, and rectal prolapse may complicate the condition. In acute proctitis, rest in bed and mild laxatives will, in a short time, bring about an improvement of the tenesmus. If extensive ulcerations are present, an emulsion of bismuth, 4 : 200, or of dermatol in the same dose, may be introduced into the rectum to form a protecting layer, as it is supposed to do in gastric ulcer. In gonorrheal proctitis, enemas of silver nitrate 1 to 100, or of sulphate of zinc 0.2 to 200 have been recommended.

The tenesmus itself is best treated by suppositories of cocoa butter, with the addition of the extract of opium or belladonna, which are added in twice as large doses as would be given internally.

Winternitz invented a cooling bulb (rectal psychrophore) which consists of a hollow metallic piece with a somewhat thickened, rounded end, which, like its neck, carries several small openings. On

the side of the apparatus are openings for the back flow of the current. Over the whole piece is fitted a rubber bulb, whose base is fixed to a disk adjusted at the place where the inflow and outflow tubes open. If water is conducted through the inflow tube into the cooling apparatus, it flows through the small openings into the rubber bulb, and from here again through the lateral openings into the deferent tube and thence outward. If by compression of the efferent tube the outflow of the water is arrested, the bulb becomes filled and extended, and in this way exerts a pressure on the rectum and the neighboring organs.

If the compression of the efferent tube ceases, the bulb empties itself and the pressure on the rectum ceases. In this way, thermic massage is given to the rectum and the neighboring tissues. This apparatus is chiefly used in the treatment of hemorrhoids, acute and chronic proctitis and periproctitis, in inflammation of the prostate, and in coccygodynia and metrorrhagia. Filled with hot water, it acts antispasmodically, and as a sedative, like a cataplasm, in tenesmus and strangury. It is applied for fifteen to twenty minutes; in inflammatory affections of the bladder and the bladder neck the use of the psychrophore is contraindicated.

Of similar action is the rectal cooling apparatus of Arzberger, which may be filled with cold water if one wishes to produce an antiphlogistic and constricting action, as in hemorrhoids, or with warm water if one wants to remove the painful spasm of the sphincter.

Periproctitis

Periproctitis causes symptoms similar to proctitis, which condition it sometimes follows. It develops after perforation of catarrhal, syphilitic, tubercular, or dysenteric ulcers, after suppuration of internal hemorrhoids, the perforation of a foreign body or, occasionally, from a spreading process in the urogenital tract.

Perityphlitic abscesses rarely burrow into the ischiorectal pouch; more frequently tubercular foci and exulcerating carcinoma of the rectum lead to periproctitis. Caseous lymph glands in the ischiorectal pouch in rare cases give rise to periproctitis.

A periproctitic abscess may perforate into the rectum or may open externally between the anus and the tuberosities of the ischium. Since the fascia of the perineum is very tight, the abscess never perforates downward. We frequently find internal and external rectal fistulæ in tubercular periproctitis. These must be treated surgically on account of the danger of miliary tuberculosis which not seldom takes its origin from these foci.

The treatment of acute periproctitis consists in rest in bed, the

application of ice-bags, compresses of aluminium acetate, cooling irrigations, as above described, and laxatives. The tenesmus must be combated with opium or belladonna suppositories. If an abscess has once formed, the pus must be allowed to drain off through incision.

Other Diseases of the Intestines Leading to Tenesmus

Tenesmus is also a symptom in intestinal invagination.

It is rare in volvulus of the sigmoid and very rare in internal incarceration. In catarrhs of the large intestine of various origins, it may be present, as in streptococcus enteritis and follicular enteritis and in dysentery, in which it helps to render the condition of the patient intolerable. In the presence of oxyures, painful tenesmus may exist even before the development of that pronounced proctitis which is so often associated with the presence of this parasite. Children, especially, complain of intolerable itching in the region of the anus; they have the constant desire to go to stool, which is produced by the irritation of the worms which creep out through the anus.

The treatment of this tenesmus consists, of course, in the removal of the parasites, but immediate relief may be given by giving a garlic enema and by rubbing the region of the anus with unguentum cinereum. The oxyures leave the large intestine through the anus from the irritation of the garlic extract and perish in the gray ointment.

The treatment of the tenesmus in the other conditions mentioned will in general be the same as in proctitis, and the primary disease will have to be combated.

The tenesmus found in rectal polyps, rectal fissures, in hemorrhoids, in prolapse and neuroses deserves a more exact discussion.

Rectal Polyps.—Rectal polyps is not a very rare affection, even in children. If one gives attention to this condition it will be found not rarely between the third and twelfth years of life. The passage of bloody stools and tenesmus demand digital examination of the rectum, and thereby we may recognize a tumor with a movable pedicle, the intestinal polyp. It is pushed over the anal orifice by means of the index finger curved into a hook, and is removed by ligature with a silk thread.

Cancer of the Rectum.—In rectal affections of elder individuals, the possibility that a rectal carcinoma has developed must always be borne in mind, and this must be decided by digital examination or proctoscopy. A timely diagnosis with immediate operation saves, according to the newest statistics, every fifth patient from certain death (Hochenegg).

Rectal Fissures.—A rectal fissure is a very painful disease, con-

sisting in very fine, scarcely visible lacerations into the mucosa of the anal ring. They are located chiefly on the posterior and lateral portions of the periphery. In some cases habitual constipation leads to the formation of such enormous rectal balls that the rectal mucosa ruptures on their passage. In other cases pointed foreign bodies, as hard enema points, may lead to injury, or a scratch with the finger-nail from the intolerable itching of the pruritus caused by oxyures. Also other diseases of the rectal mucosa, as eczema, syphilitic papules, or hemorrhoids, may lead to rectal fissure.

The treatment consists, in the first place, in the care for the stools, to prevent the passage of hard balls through the rectum.

Others, as Boas, advocate rest in bed, liquid diet, and opium to prevent opening of the bowel for eight days. After this a dose of castor oil is given. This treatment must sometimes be repeated several times. It may be aided by cauterizing the fissure with a fine-pointed silver nitrate pencil, or by painting it with ammonium sulphoichthyolicum. Dermatol or orthoform ointments may also render good service. A cotton pledget dipped in a 5 per cent. cocain solution may be introduced into the anus before each defecation, which then is usually painless, the cotton being at the same time expelled. Also, after the passage, a quieting suppository may be applied.

Rp. Extr. opii aquos,	0.02
Extr. belladonna,	0.01
Butyr. cacao, q.s. ut. f. suppositor.	

Anesthesin may be used for the same purpose, as ointment or suppository.

In many cases, however, these measures will not be found sufficient. The constant contraction of the annular muscle does not allow these minute lesions to heal, and in many cases there remains no other procedure than to relieve the sphincter for some time by cutting, (Boyer) or by stretching without incision (Recamier).

Hemorrhoids.—The treatment of hemorrhoids consists in care for soft stools, the use of compresses of aluminium acetate, and cool sitz-baths. If they bleed severely or are inflamed repeatedly, the removal surgically must be considered. The chief point in the treatment of hemorrhoids is to avoid constipation. All the patent medicines for hemorrhoids act as cathartics and are praised by the laity only because they produce a thin stool, and in this way alleviate the pain. Especially if an internal, prolapsing hemorrhoidal node is incarcerated by the sphincter muscle, violent tormenting pain in the rectal region and constant tenesmus will be present. In such cases the replacement of the node may be performed by the finger. Locally,

for the hemorrhoidal nodes, compresses of aluminium acetate may be used, and if they exulcerate we will powder them with orthoform or some other antiseptic powder. In recent times, anusol has been very much praised. It is the iodin-resorcin-sulphate of bismuth, and is best prescribed in suppositories of the following composition:

Rp. Anusoli,	7.5
Zinc. oxydat.,	6.0
Balsam peruv.,	1.5
Ol. cacao,	19.0
Ung. cer.,	2.5
Mf. suppositor. No. XII.	

Also the ointment of zymoidin and chrysarobin have found their advocators.

Kossobudskji and McDonald prescribe:

Rp. Chrysarobin,	0.08
Iodoform,	0.02
Extr. belladonn.,	0.01
Butyr. cacao, q.s. ad suppositor.	
DS. One suppository two to three times daily.	

Samways recommends the application of collodium on the hemorrhoids, having observed a gradual diminution in the size of the nodes by this method. Since the application of collodion is painful, the anal region would better be previously brushed with cocain.

If the discomfort from hemorrhoids is severe, they must be removed surgically, according to the methods of to-day.

Strictures of the Rectum.—Rectal strictures only rarely develop from ulcerating and phlegmonous processes, or after surgical intervention on the rectum, as cauterization of hemorrhoids. Colic is almost constantly present, but no tenesmus.

The treatment consists in the passing of bougies, or in the plastic operation.

Prolapse of the Rectum and Anus.—Prolapse of the rectum must not be mistaken for the prolapsing invaginated colon. Examination with sounds will prevent this diagnostic error when we try to pass the sound between the prolapsing portion and the sphincter; if the sound penetrates deeply it will speak against prolapse of the rectum and for that of the colon.

Prolapse of the rectum, as well as of the anus, is chiefly found in children in the first years of life, more rarely in adults. The cause of this predisposition of children lies first in anatomical conditions. Above all, the slighter curvature of the sacrum and the more direct course of the rectum and a certain elasticity of the periproctal tissues predispose to this lesion. Moreover, in childhood there exist fre-

quent irritations which cause a too energetic and continous straining of the abdominal muscles; thus accumulations of oxyures in the rectal ampulla, urinary calculi, phimosis, pertussis, and a too long sitting on the vessel. If the prolapse is extensive, it is usually associated with considerable pain, which increases during each passage.

If we find an anal prolapse, we will first replace it with the well-oiled index finger, fixing the region around the sphincter by the fingers of the left hand while the right index finger pushes back the prolapsed mucosa. If an extensive prolapse is present, the reposition must be at the extreme end of the prolapsed part of the intestine by first folding in the unfolded intestine and, when this has been accomplished, by pushing the rest through the sphincter *in toto*. During this procedure the patient should lie in such a way that the pressure of the abdominal muscles is, as far as possible, excluded; preferably in the knee-elbow position, or at least in a prone position, with hips elevated. If the patients are unable to relax their abdominal muscles a general anesthetic will have to be given. When the replacement has been accomplished by the use of adhesive plaster bandages, one must aim to prevent recurrence of the prolapse, which may be accomplished by the use of a T-bandage or a rectal supporter of Esmarch. Rubber ballons have been recommended to prevent prolapse. Spindle-formed excisions of the rectal mucosa and thermocauterization are not to be recommended, but cauterization with silver nitrate, performed at intervals of a week, are of service by producing an energetic contraction of the rectal mucosa. Care for the bowel is of course necessary to avoid a recurrence. One must combat the relaxation of the intestinal mucous membrane by combating the primary condition which caused it. The tonus of the musculature is raised by subcutaneous injections of ergotin (0.1 gm. *pro dosi*) or strychnin in doses of 0.001 to 0.002 gm.

It has also been recommended to improve the tonus of the sphincter by massage, as indicated by Thure-Brand. This technique consists in massage of the rectum and sphincter and of the region of the sigmoid flexure, and in tapotement of the sacral region, which may influence the tonus of the sphincter by stimulating the motor center in the cord.

Diseases of the Neighboring Organs

Through a diseased condition of the organs about the rectum, pain may develop, with exacerbations during defecation, even if no pressure is exerted on the rectum. We have in many cases to deal with an irradiation of pain.

Cystitis.—Patients suffering from acute cystitis sometimes com-

plain of pain in the rectum and of tenesmus, if the cystospasm is of a severe degree.

Bladder Stone.—In urinary calculi, whose position, as, for instance, at the internal orifice, and whose small size exclude the possibility of their exerting any pressure on the rectum, radiation of pain into the rectum is occasionally found in the same way that sometimes the pain is localized in the end of the glans penis. A similar behavior occurs in neoplasm of the bladder and in affections of the prostate.

Diseases of the Prostate.—Pain on defecation is one of the chief and most disagreeable symptoms in acute inflammation of the prostate. Here, also, we shall have to give our attention to the consistency of the stools, and we may, as Guyon has recommended, apply leeches upon the perineum and around the anus. V. Frisch advises the application of large, hot cataplasms to the perineum, combined with the use of gray ointment. Warm enemas or the use of a rectal cooling apparatus will be of good service if the inflammatory manifestations are very severe. If the pain is not relieved by suppositories containing morphin, belladonna, or extract of opium, we shall have to give subcutaneous injections of morphin.

Neuralgia in the Region of the Rectum.—Neuralgia of the rectum, bladder, and genitals are conditions which, clinically, are very intimately associated, as is readily understood by their common nerve supply. The sacral plexus supplies all these organs; and the inferior hemorrhoidal nerves as well as the common pudic nerve are branches of the coccygeal plexus which is a part of the sacral plexus. From the common pudic nerve is derived the N. dorsalis penis and the nervi perinei. Thus anal, perineal, and scrotal neuralgias and those of the glans penis are found associated. Here belong the spermatic neuralgia (irritable testis) and the anal-perineal neuralgia, which Weir Mitchell found occasionally in tabes, but which also occurs after sexual excesses and masturbation. The pain in the anal and perineal region appears especially at night and is not usually exacerbated on defecation.

Cystalgia (irritable bladder) is chiefly found in diseases of the prostate, rectum, and female genitals, and also of the kidneys.

Pains of the urethra in tabes are described as urethral crises. Also the penis and prostate may be the seat of tormenting neuralgia.

Noteworthy is the observation of Seeligmüller, that violent pain *in ano* and in the genitals precedes, not infrequently, an eruption of herpes.

Coccygodynia (*Coccydynia*).—Pain in the region of the coccyx is called coccygodynia. This condition should be diagnosed only after an organic affection of the bone, as caries, has been excluded. The patients complain of intolerable pain, exacerbating on different

positions of the body. Some complain of an increase of pain on walking, others on sitting or on emptying the bladder and rectum. Women, who suffer much more frequently from this affection than men, complain often of very violent pain during cohabitation. As a cause of this condition we find, in some cases, a trauma, as a fall on the buttock, in other cases persistent traumatic agencies, as riding, dragging in severe labor. In other cases, colds or sexual irritation are made responsible for the condition. Strümpell found it in the course of tabes. An attack of the pain may sometimes be produced by pressure on the coccyx.

The treatment has to take into consideration the primary condition. If we have to deal with a generally nervous constitution, climatic therapy, sanatorium treatment, and hydrotherapy will bring about relief. Sometimes we shall have to combat the symptom itself. Tepid sitz-baths and quieting suppositories and, in severe cases, subcutaneous morphin injections give immediate relief. If sitting is very painful, it is advisable to use an air cushion. Naegeli sometimes accomplished good results by the manual stretching of the soft parts around the coccyx. In cases where all these measures fail, circum- or even excision of the coccyx, as advocated by Simpson, is the last resort. Where violent pain of the bladder is present at the same time, treatment by psychophores gives good results sometimes.

Neftel observed isolated neuralgias of the rectum, especially in anemic individuals, also in convalescence from malaria and after proctitis and dysentery.

In some cases the pain is entirely independent of defecation, in others it lasts for hours after it.

C. METEORISM

General Remarks

Inflation of the abdomen by gas within the intestinal loops we call meteorism. An abdomen distended by meteorism may be differentiated from ascites on careful inspection. For in meteorism the flanks are not the protruding parts as in ascites, but the inflation involves chiefly the anterior part of the abdomen. It may be distinguished from the fat abdomen by inspection of the navel, which is, in obesity, deeply retracted, which is not the case in meteorism. Meteorism may be distinguished from ileus on inspection, by the fact that in this latter condition violent peristalsis is usually present at the onset, unless we have to deal with strangulation, which is associated with local immovable meteorism.

Meteorism of the Large and Small Intestines.—The differentiation of meteorism in the small and large intestines cannot be made from

the caliber of the inflated loops, as might be supposed, for if the inflation is of a high degree the loops of the small intestine become the same size as those of the large.

The examination of the inflated abdomen discloses a high tympanitic sound and sometimes also the auscultatory-percussion phenomenon, the diaphragm at the same time standing high. It is important to know that there may exist a disproportion between the distention of the abdomen and the meteorism, namely, when the tonus of the abdominal musculature is higher than that of the diaphragm. In this case the abdomen will be only slightly inflated and the gas will cause only an excessive displacement upward of the diaphragm, with all its harmful sequelæ; for a high position of the diaphragm severely hinders respiration and indirectly the circulation, from the insufficient aspiration of venous blood into the thoracic cavity.

Pathogenesis

Increased Formation of Gas.—The most frequent pathogenetic factor in meteorism is increased production of gas. Putrefaction may even develop in the small intestine which normally is not the case. In all disturbances of passage in the ileo-jejunum, the gaseous products of putrefaction, CO_2, H_2S, NH_3 and H_2, may be formed here, though their proper place of origin is in the large intestine. On the other hand, the gaseous products of *fermentation*, as of the lactic acid and butyric acid fermentations, are normally found in the small intestine. In fermentative dyspepsia, however, this process exceeds its normal limits. Marsh gas, a constant constituent of intestinal gases, is produced partly from cellulose, partly from proteins.

In diarrhea, a marked flatulency may be present, originating in this way; from too rapid moving of the intestinal contents, chyme, insufficiently digested, reaches the large intestine and here undergoes a high degree of decomposition, as too ample nutritive matter is present.

Decreased Resorption.—Another factor in the development of meteorism is the decreased resorption of gas. Lauder-Brunton and Cash have proved that a large quantity of intestinal gas is resorbed and exhaled by the lungs. Since sulphuretted hydrogen is a severe poison, one would expect that, by the resorption into the blood, manifestations of severe intoxication would arise. However, hydrothionemia is an exceedingly rare affection which certainly does not result from the absorption of intestinal gas. For the amount of H_2S in the intestine is not as high as might be expected sometimes from the odor. For in many cases it is methylmercaptan which simulates an excessively high content of H_2S, especially marked after the ingestion of leguminoses.

Diffusion of Carbon Dioxid into the Intestinal Canal.—In the diffusion of the CO_2 from the blood into the intestinal canal, we may find another cause for meteorism. Nothnagel gives this explanation for those cases in which meteorism follows severe mental emotions.

In the same way meteorism may be explained in the different conditions associated with cyanosis, as in cardiac affections, liver cirrhosis, and arteriosclerosis of the intestinal vessels. Occasionally, as Jaworski suggests, angina pectoris leads to meteorism from a sudden insufficiency of the heart.

Occurrence and Significance of Meteorism

Meteorism is often an insignificant affection. We find it after the ingestion of young wine and young beer, as well as after foods which are considered as easily fermentable. It is a question whether this meteorism is still physiological A. Pick, is of the opinion that we do not here deal with entirely normal conditions, for a normal intestine must be able to resorb any amount of CO_2 which, passing into the blood stream, is exhaled by the lungs; and it is CO_2 chiefly that we have to deal with in fermented beverages. There exists probably a disturbance of resorption produced by the irritation which the gas exerts on the intestinal mucosa.

In certain other cases meteorism may be of no significance, namely, if caused by swallowing of great quantities of air, as is frequently found in hysterical patients, the so-called aerophagites. Meteorism is frequent in constipation and diarrhea, though it may be stated that constipation may exist without any meteorism. Then, though the passage of gas through the anus is hindered, the resorption remains undisturbed.

The subjective sensations of meteorism may be very annoying. Patients complain of a sensation of pressure, of fullness and distention in the abdomen, of epigastric pain and colic, frequently localized at the flexures of the colon.

Precordial anxiety and irregular cardiac action develop in many cases, and, reflexly, bradycardia and vertigo. Whether these symptoms are caused by increased blood pressure, as Federn the chief advocate of the doctrine of the partial intestinal atony believes, or whether we have to deal with the effect of autointoxication cannot be decided here.

Patients with beginning tuberculosis of the intestines complain sometimes of meteorism and pain, which they localize usually in the epigastrium corresponding to the position of the transverse colon.

In some cases there is a disproportion between the subjective complaints and the objective findings which may readily be explained by

autointoxication from the intestines. Thus the tympanites often found in the hysterical, due to aerophagia, produces usually no discomfort, whereas the dyspepsia of infants causes intense pain, so that the children cry day and night.

The symptomatic meteorism occurring in intestinal occlusion or stenosis has been discussed in another place.

Meteorism is found, further, in various infectious diseases, as in typhoid fever from its very onset. If the meteorism is very severe in these diseases, it may sometimes lead to great difficulties in the differential diagnosis. In typhoid perforation may result, with the symptoms due to the passage of air into the abdominal cavity (pneumaskos), so that in a bad general condition it may be difficult to distinguish between meteorism and pneumaskos. Leube calls attention to the fact that in both conditions hepatic and splenic dulness may have disappeared, that the diaphragm stands high and that the epigastrium protrudes like a balloon. The transverse colon, if very much inflated, may cause the disappearance of the dulness of liver and spleen. Leube recommends in these cases that the patient be placed on the left side. Thereby, if it is only a case of meteorism, we find constantly a small zone of liver dulness over the eighth rib, whereas on the presence of air in the abdominal cavity even this zone sounds tympanitic.

Treatment of Meteorism

The treatment of meteorism will depend first on the primary disease. In the course of peritonitis, typhoid fever, or sepsis it must be combated according to the indications valid for these diseases.

If meteorism is a symptom of intestinal atony a mixed diet, with a predominance of vegetables, sometimes gives excellent results, stimulating intestinal activity in its motor as well as in its secretory functions. v. Noorden and Dapper recommend in these diseases a nourishment rich in dross. In prescribing milk we must consider individual idiosyncrasies. There are patients on whom the milk acts very favorably and others in whom meteorism develops at once after the use of milk. Intestinal atony may be effectually combated by massage and faradization. In a transient severe constipation we may try to give relief by calomel and, if the meteorism is very tormenting, by introducing an intestinal tube into the rectum and attempting to relieve the gas by intestinal massage. Attempts have also been made to aspirate the intestinal gas by rectal tubes. The puncture of the inflated intestinal loops is never necessary in the common form of meteorism.

Though it is impossible in the strict sense of the word to disinfect

the intestine, nevertheless there is a series of remedies by which the fermentation processes in the intestines may be decreased. These are creosote, creosotal, menthol, thymol, ammonium sulphoichthyolicum, ichthoform, ichthalbin, hopogan, and resorcin; also purified wood charcoal, through its great absorptive faculty, gives good results. Bismuth salicylate, salol, or betol are also used for this purpose. Bouchard recommends the following prescription:

Rp. Beta-naphthol, 15.0
Bismut. salicyl., 7.5
Mf. Pulv div. in dos. XXX.
DS. One to four powders three times a day.

Yvon and Berlioz recommend the administration of β-naphthol in half-gram doses, four to five times a day.

A number of remedies of a carminative action were especially valued in earlier times, such as asafetida, oleum caryophyllorum, ol. carvi, peppermint, fennel, anis, sweet flag, caraway, camomile, cascarilla. It is certain that these drugs have some effect; thus aqua carminativa has undoubtedly a carminative action if given in teaspoonful doses. This action has been explained in various ways. Brunton and Cash believe that the gas resorption is augmented by it; others that the spasms of the intestinal tube are relaxed by it, or that a more energetic peristalsis is produced, leading to the passage of the gas.

For flatulency the following is of use:

Rp. Extr. fab. calabar, 0.05
Glycerin, 10.0
DS. Five to six drops three times a day.

Meteorism in Infants

Meteorism plays a great part in the affections of children, especially in infants. It is the cause of the constant crying of dyspeptic children; no serious affection is necessarily present, which may be recognized by the fact that these children thrive very well. In some cases meteorism is said to lead to eclamptic attacks, which doubtless is the case in those children who suffer from "spasms of hyperexcitability," as in the tendency to laryngospasm. In these children the frequency of laryngospastic attacks is increased by the meteorism. The treatment must aim to relieve the dyspepsia, which is the cause of the flatulency. If amylaceæ are given too early or if too much milk-sugar is added to the milk, meteorism appears. These are the fermentation dyspepsias, associated with meteorism, which disappear as soon as the injurious factor is removed from the food. Breast-fed children, too, suffer frequently from meteorism, and in these cases it becomes a symptom which disturbs the night rest. Nevertheless

the children often thrive excellently. The following prescription may be given:

Rp. Aqu. carminat.,
Aqu. menth. pip.,
Aqu. fœniculi, āā 15.0
Aqu. destill., ad 90.0
Aqu. lauroceras, gtts. ii–iv
Syrup simpl., 10.0
DS. One teaspoonful every two hours.

Rp. Tinct. ratanh., gtts. xv : 70.0
Syrup. simpl., 10.0
DS. One teaspoonful every two hours.

Very much in favor with children's nurses are the carminative ointments, also camomile tea, by mouth and as enema; these ointments of whatever composition, act only through massage of the intestine, and therefore, if they produce no eczema on the skin, may be permitted. The effect of the abdominal massage may be increased by introducing a well-oiled soft-rubber tube high into the intestines. If one rubs the abdomen along the large intestine, great quantities of gas may be expressed. From the use of camomile internally or as enema, one often sees immediate relief of the discomfort, though it is not always advisable to fill the stomach unnecessarily with large quantities of liquids and to produce atony of the intestine by frequent enemas.

In breast-fed children success is often gained by the institution of regular feeding times, every three to four hours. If this gives no help, the milk is omitted for one day, and only tea and two calomel powders of 0.1 gm., at an interval of two hours, are given.

The inflation of the abdomen at a later period of infancy and in the first years of childhood is known as the "frog abdomen." When the child sits up or strains, three protrusions appear, one in the middle, corresponding to the diastasis of the recti muscles, and two laterally, corresponding to the yielding parts of the oblique muscles. This "three-hill" abdomen is always a symptom of a high degree of atony of the abdominal muscles.

The rickety abdomen is partly caused by the digestive disturbances so common in this disease, but certainly in part by the marked relaxation of the abdominal muscles. Thus in diseases leading to a decreased tonus of the abdominal muscles, as mongolism, we find a constant inflation of the abdomen associated with umbilical hernia.

In this chapter we have not considered a condition which also leads to meteorism, but which is not caused by changes in the abdomen itself. This is paresis and paralysis of the abdominal muscles, in which the normal amount of gas in the intestines is sufficient to produce inflation on account of the slight resistance of the walls.

CHAPTER XII

EXAMINATION OF FECES

GENERAL REMARKS

The examination of the feces gives us manifold information as to the morbid condition of the digestive tract. Though a diagnosis is possible in some diseases of the stomach and intestines, without a chemical and microscopical examination of the stools, this should never be omitted in important cases. For it informs us as to the resorption of the food, as well as concerning the activity of the digestive glands, and about diseases of the intestinal wall of which no definite knowledge could be gained in any other way. The composition of the feces offers great variations and it is therefore important to distinguish the normal constituents from the abnormal ones.

Undigested Particles.—The stool consists of the remains of ingested food, a part of which is completely indigestible, as cellulose, chitin, gums, nuclein, mucin; further, of food remains which are difficultly digestible, as bones, cartilage, tendon, and, finally, of those food rests which, though digestible, have escaped digestion from some cause. To these must be added decomposition products of the food. Further, there are in the stool the glandular secretions, bile and intestinal juices, epithelia of the intestinal mucosa, and innumerable bacteria which make up about one-half of the whole dried substance.

Among the pathological constituents may be named pus and blood, parasites and their eggs, and particles of tissue.

Like every other organ, the intestine, too, has a certain functional capability. If this is overstepped the organ can no longer respond to the demands placed upon it. This is first expressed by an increased amount of undigested food particles.

Composition of the Feces.—The composition of the feces will vary, according to the quality and quantity of the food ingested, even in the healthy person, as these two factors, together with the functional capacity of the digestive organs, are the determining moments. If this capacity is overstepped by a too abundant food supply, a considerable number of food particles will be present in the stool consisting of otherwise easily digestible food.

Undigested protein is not found in the feces in normal conditions, but the substances formed from it by putrefaction, skatol, indol, phenol, ammonia and H_2S are present; also the volatile fatty acids,

produced by the fermentation of carbohydrates, as formic, acetic, lactic, butyric acids, etc. The fat is split up into fatty acid and glycerin, and these are again, for the most part, saponified, and are then found in the stools exclusively as lime soaps.

Examination of the Feces: Schmidt's Test Meal.—A uniform diet of certain composition is necessary to demonstrate slight deviations from the normal. We recommend the test diet of Schmidt and Strassburger.

In the morning: 1/2 liter milk or, if milk is badly tolerated, 1/2 liter cocoa made from 20 gm. cocoa, 10 gm. sugar, 400 gm. water, and 100 gm. milk, 50 gm. zwieback.

In the forenoon: 1/2 liter oatmeal soup, made from 40 gm. oatmeal, 10 gm. butter, 200 gm. milk, 300 gm. water, and 1 egg (strained).

Noon: 125 gm. hashed beef, slightly roasted with 20 gm. butter, so that it is still raw inside; 250 gm. mashed potato, made from 190 gm. mashed potato, 100 gm. milk, and 10 gm. butter.

Afternoon: As in the morning.

Evening: As in the forenoon.

This test diet, according to Schmidt, should be given for three days and even for longer, until there is a stool which is derived only from the test food, which usually is the case after the second defecation, if the bowels move normally. Since the normal stool can, as a rule, be recognized by its uniform consistency and light color, the administration of carmin, which Schmidt used (in doses of 0.3 gm. cachet) at the beginning and end of the experiment, may generally be omitted.

Quantity and Number of the Stools.—The quantity and number of the stools are larger on a vegetable than on a mixed or chiefly meat diet. According to Schmidt and Strassburger, the cause does not lie in the more rapid passage through the intestine, but in the fact that the stimulus exerted by the feces on the intestinal mucosa is greater on a vegetable diet, so that even small quantities of feces are sufficient to stimulate defecation.

The observations of Franz Müller on Cetti and Breithaupt, and of Luciani on Succi, three artists in starvation, prove that, even on complete fasting, some feces are produced, which in these men amounted to 2 to 5 gm. (in the dried state) per day.

Weight.—The weight of the feces is dependent on the amount of food consumed. According to Liebig, it is 1/7 to 1/8 that of the food ingested.

Color.—The color of the feces depends on the quality of the food, and especially on the presence of hydrobilirubin, a derivative of the biliary pigments. The stool is in general lighter in color the more liquid and abundant it is. On milk diet it is light yellow; on mixed diet

brown, and lighter in proportion as more vegetable food has been taken; on meat diet dark brown. Decomposed blood, originating from the higher portions of the intestines, gives a black color to the stool. Then it may often present a tarry aspect; it may, however, be black from certain foods and medicaments. Huckleberries, dark red wine, bismuth, manganese, and iron preparations thus may cause a black color. Rheum, senna, santonin, and gamboge color the stools yellow, and, on decided alkaline reaction of the stools, reddish. A greenish-yellow color is usually due to undecomposed biliary matter.

Color of Infants' Stools.—Bilirubin is normally present in the stools of infants in whose intestines the processes of reduction are still absent. At a later age, however, it is found only under pathological conditions (Pettenkofer).

The frequent green discoloration of infants' stools has not nearly so much significance as is attributed to it by mothers. In most cases it is produced by biliverdin, an oxidation product of bilirubin, formed in the intestines under conditions which are not quite clear. A. Hecht has recently proved that the reducing power of the bacteria in the green stools is exceedingly slight. Under some conditions, the green color may be due to the B. pyocyaneus (Salus).

Lesage cultivated a bacillus from green stools, which was never found again and which formed a green pigment in his colonies.

It may be mentioned that formerly an abnormal production of acid was considered responsible for the occurrence of green stools, whereas at present Pfeiffer and Biedert take the point of view that the high alkaline content of the infants' stools in the upper portions of the intestine is the cause of the green discoloration.

The normal color of the infant stool is orange or egg yellow; on artificial feeding its color is more brownish, though very many healthy, thriving, breast-fed children can be found who have a whitish-yellow, speckled stool (physiological fat-dyspepsia). Sometimes the feces of infants, especially of constipated ones, are of a very light color after cow-milk feeding, often, indeed, white. In such cases we have to deal with the reduction of bilirubin to urobilinogen (Langstein, Festschrift f. Salkowski, 1904). We find these whitish stools also in hindered biliary and pancreatic secretion, in digestive disturbances of atrophic children, in tuberculosis of the mediastinal lymph glands, and in peritoneal tuberculosis.

Acholic Stools.—If the biliary secretion is obstructed, the stools assume a bright gray color. This light color, however, is caused not merely by the absence of the bile, but also by the abundant content of fat.

Acholic stools may be observed in the absence of jaundice, perhaps due only to a periodically interrupted flow of bile or to the

fact that the fat content of the feces is so high that, though biliary pigment is present, a white color is produced obscuring the normal color. It is possible that in some cases leucohydro-bilirubin is formed by reduction. Nothnagel and v. Jaksch observed, sometimes, clay-colored stools in chlorosis, intestinal tuberculosis, and chronic nephritis, though no jaundice was present. Also in scarlet fever, dysentery, cholera, and chronic enteritis, acholic stools may be met with. They may be met with, finally, on the use of Karlsbad waters.

Odor.—The specific odor of the feces is due chiefly to the presence of skatol. It is very pronounced in intestinal ulceration, carcinoma, dysentery, typhoid fever and, generally, on increased putrefaction of the intestinal contents. An odor of glue was observed by Boas in amebic dysentery. The intense stench of acholic stools only develops when decomposition processes are associated with the absence of bile (Schmidt and Strassburger). In marked carbohydrate fermentation the stools have a rancid odor, and in the presence of large quantities of mucus, pus, or blood an insipid one.

The normal stool of the breast-fed child should not have a feculent odor at all, but rather a mild, acid odor of butyric acid. Only when the children are constipated or suffer from intestinal catarrh do the stools assume a fecal odor. It is sometimes found in the healthy, artificially-fed child, but only to a slight degree.

Form and Consistency.—The form and consistency of the stools vary a great deal. The latter depends chiefly on the amount of water in the feces. The normal stool is firm and pasty, and, on meat diet, of denser consistency and smaller quantity than on vegetable diet. A pronouncedly mushy stool must be considered pathological, provided the diet is normal and no laxatives have been taken. These stools occur in the various forms of diarrhea, and their watery consistency increases with the intensity of the disease. In cholera the stool resembles rice-water, in typhoid, a badly cooked pea soup.

The firm fecal masses have the characteristic elongated form. Sometimes they consist of several hard lumps, at other times of numerous smaller ones, so that the stool has the so-called sheep-stool quality (scybala). This has no special pathognomonic significance, but is sometimes observed in intestinal stenosis. Here the stool often takes on a ribbon-like form. The occurrence of thin fecal columns is not infrequent in spastic contraction of the intestinal musculature, chiefly of the anal sphincter.

Nothnagel observed this form in gastric carcinoma; Fleiner in spastic and paralytic conditions in the large intestine. The stool of inanition may also show this form. Experience teaches that this quality of the stool may be absent, even in a low-sitting stenosis.

According to Boas, a stool composed of few small finger-like cylinders in a pulpy evacuation is more characteristic for intestinal stenosis.

The cohesion of the stool is best determined by rubbing up the stool with water in a porcelain mortar. Mucus and fat are apt to increase the cohesion, gas bubbles to decrease it. The pathological stools of infants often show a lack of cohesion (hacked stools).

EXAMINATION

A. Macroscopical Examination

The macroscopical, microscopical, and chemical examination of the feces often furnish points of great diagnostic value. For the technique we refer to the excellent work of Strassburger, "The Human Feces in Normal and Pathological Condition." Here only the most important results will be given—those whose knowledge will be of value for the practitioner.

Parasites; Gall-stones.—Some pathological constituents, parasites, gall-stones, may be recognized with the naked eye. In searching these a stool sieve of Boas or of H. Strauss will be useful.

Undigested Food Particles.—If the consistency of the stools is increased, water must be added. Undigested particles sometimes may also be recognized macroscopically: their presence points to a disturbance of digestion or resorption. Particles of unchanged food are most frequently found in diseases of the pancreas, and with greatly increased peristalsis—conditions associated with a disturbed metabolism. The presence of undigested food particles in the stools is called lientery.

Connective Tissue —The gastric juice alone has the faculty of digesting connective tissue. For this reason we will expect abundant rests of connective tissue in the stools in gastric achylia. This finding will permit the conclusion of a disturbed stomach secretion, except when the connective tissue is especially indigestible, as is the case with raw ham, on account of the smoking process.

Meat Particles.—As far as meat particles in the stools are concerned, W. Zweig found that with a daily ingestion of 100 gm. raw finely hashed beef, no meat particles could be recognized in the feces macroscopically. If present, without connective tissue, they point to a disturbed intestinal digestion, including the pancreas, in its motor, secretory, or resorptive function.

Fat.—If the flow of bile into the intestines is disturbed, the fat digestion suffers, but only rarely can fat be demonstrated macroscopically. Nothnagel observed repeatedly liquid masses in the stools which he recognized to be fat by their rapid hardening. However, it is advisable to verify such findings by microscopical examination.

On abundant vegetable diet, plant rests are demonstrated in the stools in large quantities, even macroscopically. Pathological admixtures may often be recognized as such by the naked eye; thus the presence of mucus, pus, and blood, the last of which retains its original color only if derived from the lower parts of the intestines; if it originates in the higher portions the stool is often of tarry aspect.

B. Microscopical Examination

Meat Fibers.—In human beings, even after a moderate meat diet, meat remains are constantly found in the stools on microscopical examination. They consist of pieces of muscle of moderate size, stained yellow or brown by biliary pigments, and, according to Nothnagel, usually not striated. If the muscle fibers are very numerous, if their corners are not rounded from digestion, if their transverse striation is preserved and their color due to bilirubin instead of urobilin, we are justified in suspecting a catarrh of the small intestine. Valuable information on the digestion of muscle fibers is furnished by the meat test of Schmidt (*Deut. Arch. f. klin. Med.*, Bd. lxv, S. 219).

Cheesy Masses; Milk Granules.—In the stools of adults, as well as in those of children, soft caseous masses of the size of a lentil and larger, whitish or tinged yellow with bile pigments can sometimes be found. Monti and Biedert believed them to be casein flakes; Widerhofer and Wegscheider conglomerations of fat imbedded in some matrix. From these must be differentiated the so-called milk granules, representing yellowish balls the size of a pinhead, chiefly found in infants' stools and even under normal conditions. The coagula, according to Leiner, are not casein proper, as Nothnagel supposed, but they contain a pseudomucinous substance. Numerous fat-crystals and fat-droplets as well as many bacteria are imbedded in these formations, and to the latter fact is due the positive Millon's reaction. These so-called "casein flakes" are pathological findings. If stained with bilirubin, in adults, they prove a still higher degree of disturbance.

Starch.—Starch if ingested in the raw condition appears in the stools in the form of concentrically or, excentrically stratified, round or oval bodies which show fissures extending radially from the center, or incisions which run from the periphery toward the center; under normal conditions they are seldom found in the stools of adults, according to Sahli, but in infants' stools they are found after inappropriate feeding with starch.

Test for Starch.—It may be readily recognized by means of Lugol's solution, but Rubner thinks that the stool should be energetically rubbed up with this solution, as it penetrates into plant fibers only

with difficulty, especially if mucus is present or the starch granules are imbedded in cellulose. They are thus stained bluish-black or dark blue, or red if the transformation into erythrodextrin has taken place. Most important to ascertain is whether the starch appears in the stool in a free condition or imbedded in vegetable fibers. The latter is of little importance, and on examination of stool preparations careful attention must be given that vegetable cells are not ruptured by the pressure of the cover-glass setting free the starch granules contained in them.

The admixture of starch in the stools may be brought about by the external use of starch powders (talcum powders).

According to Schmidt and Strassburger, only isolated starch rests, more or less agglutinated, are of value for the diagnosis. Unsplit starch is present in the stools of adults also under normal conditions. Further, Schmidt and Strassburger proved by their fermentation test, as well as by the microscopical examination, that it is by no means only the severe diseases of the intestines which lead to a reduced starch digestion. The common fermentation dyspepsia of the intestines is sufficient to cause the appearance of considerable quantities of undigested starch in the stools. But the disturbed resorption must be limited to carbohydrates; if other constituents, especially fat, appear in the stools, it points to an injury to the whole resorption function of the intestines.

The occurrence of agglutinated starch in the stools speaks for a more severe disturbance of resorption than does the presence of muscle fibers. Split starch is absent from the normal stools of infants who have received some starch with their milk. If infants who have been nourished with milk exclusively suddenly receive large quantities of floury foods, unsplit starch will be found in the stools.

The presence of cellulose allows no far-reaching conclusion, as it occurs also under normal conditions; its quantity depends on the quality of the vegetable matter ingested and on the peristalsis of the intestine.

Fat.—Fat occurs in the stools in three forms—as neutral fat, free fatty acids, and as soaps. Neutral fat appears in the form of irregular bodies, white, opaque, slimy, and, as a rule, uncolored, of different sizes and irregular in form or in the form of droplets. The free fatty acids occur in irregular masses as well as in thin tapering crystals. Nothnagel identified these for the most part as lime soaps by adding concentrated sulphuric acid to the preparations, whereby the soap was split up and calcium sulphate appeared in its characteristic crystals. The soaps appear as more plump, broader leaflets, which occur singly or in bunches.

Neutral fat is found in the very fat stools of breast-fed children,

indeed the younger the child is, the greater the amount of fat which appears in the stool as neutral fat. In elder children and in healthy adults neutral fat may be completely absent from the stools. In the latter the greatest part of the fat occurs in the form of calcium soaps and a small part as magnesium soaps. After the test meal of Schmidt and Strassburger, needles of fatty acid are not found normally, whereas in the stools of icteric persons, soap, crystals, and masses of fat constitute the greater part of all microscopical constituents. They are augmented further in increased peristalsis, fermentations, and enteritis. Disturbed gastric digestion does not much influence the fat resorption, and therefore leads to no changes in the stool-picture. The same is true of the catarrh of the large intestine. On the other hand, the fat resorption is severely reduced in catarrh of the small intestine; also when the peristalsis is so much increased, in severe disorders involving this portion, that the food passes too rapidly through the small intestine; in diseases of the mediastinal glands; and, above all, on a hindered biliary secretion. The splitting up of fat into its compounds may be entirely normal, according to Fr. Müller. By the great amount of fatty acids in the acholic stools the strongly acid reaction of the feces in jaundice may be explained.

Pancreas Affections.—In pancreas affections this behavior is quite the opposite. According to Fr. Müller, the splitting of fat suffers here, and incomparably more neutral fat will appear in the stools than normally. The fat resorption, on the other hand, may be relatively good.

Fat in Infants' Stools.—In infancy the feces of breast-fed children contain fat in a considerable quantity. If concentrated sulphuric acid is added to such a stool, it seems, after heating, to consist only of fat droplets. In children who are fed with cows' milk this must be considered as a pathological finding, as only few fat drops appear normally in the cow-milk stool. Well-nourished bottle-fed children have about twice as much stool as those fed at the breast, though the peristalsis in the artificially fed child is usually much more sluggish. An increased quantity of fat is found in the infant stool, not only in severe diarrheas, but also on increased peristalsis and on fermentation dyspepsia. Twenty per cent. fat may be considered normal in the infant stool (figured from the dried residue). The disturbances of fat resorption just mentioned easily lead to a much higher percentage. If the dried stool has a fat content of more than 50 per cent., a severe disorder of resorption must be inferred (Biedert). In adults the amount of fat depends on the food, so that it is impossible to give standard values.

Milk Disturbances.—In milk diet disturbances (Milchnähr-schaden) fat dyspepsia exists; though the splitting of fat is entirely sufficient,

the stools are of a light gray color, dry, not adhering to the napkin, and consisting chiefly of fatty soaps. The faculty of these stools to absorb water is so slight that they cannot be softened by a water enema.

Fat Diarrhea of Infants.—In the fat diarrhea of infants, as described by Demme and Biedert, the fat content of the stool exceeds 40 per cent.. According to Tschernoff, such a percentage of fat may be found also in dyspepsia.

Charcot-Leyden Crystals.—The appearance of Charcot-Leyden crystals is said to speak for the presence of worms in the intestines, but this finding is not sufficiently constant to have any sure diagnostic value.

Mucus.—Mucus in the stools is of great importance for the diagnosis of digestive diseases. The meconium and the stools of very young infants may normally contain small amounts of mucus. The meconium plug of the new-born, a short column of mucus of a glassy quality or grayish color, is of no pathological significance. A. Hecht had occasion to observe it in a high-sitting anal atresia, which proves that the plug originates in the lower portion of the intestine. Any macro- or microscopically demonstrable admixture of mucus in the stools of adults has, according to Nothnagel, to be considered pathological, whereas by chemical methods mucus can be demonstrated in the stools even under physiological conditions. If large, inspissated fecal balls remain for a long period in the lower portions of the intestines a slight layer of mucus may be found over the feces which, if dried, resembles a coating of varnish. In these cases the production of mucus must be considered as a kind of physiological hypersecretion of the rectal mucosa, produced by the irritation of fecal matters on the rectal mucosa.

The appearance of considerable amounts of mucus in the stools following the use of strong laxatives, Boas believes to be a physiological phenomenon. Though mucus must, as a rule, be considered a pathological finding, a catarrh of the upper intestine cannot be excluded with certainty from its absence, for as mucus is one of the more readily absorbed matters the mucus produced in the small intestine may evade observation.

The bile-tinged color of the mucus, according to Schorlemmer, is no proof that the mucus comes from the small intestine. According to his investigations, the latter is the case only when we have to deal with very small particles, just recognizable macroscopically, intimately mixed with food matters, and containing, under the microscope, half-digested cells and granules of bilirubin crystals. Sometimes little clumps resembling frog spawn or boiled sago are found, which consist mostly of mucus. Virchow and Nothnagel believed them to be of

vegetable origin. Pediatricians formerly frequently inferred the presence of follicular ulcers or dysentery from these findings.

The occurrence of mucus has further been described by Nothnagel, in the form of pinhead to pea-sized granules of yellowish-brown color of the consistency of butter. Nothnagel believed them to be mucus or a substance similar to mucin. Other authors, however, believe that granules consisting of mucus do not occur in the intestine, and that these yellow bilirubin-containing bodies, whose ground substance is protein, come from the small intestine and speak for a rapid passage of the contents.

Sometimes mucus is found in large, twisted, cord-like pieces, and in the form of membranes which may appear as tubular molds of the intestines. These are chiefly found in membranous enteritis, a nervous affection of the intestines.

Attention should be given, further, to the number of bacteria and the different elements and crystals contained in the mucus. If the mucus contains many bacteria and much detritus, bilirubin granules and crystals, one will conclude that it comes from a high portion of the intestine. For the diagnosis of disturbance of the small intestine, the presence of these bile-tinged particles is not sufficient, but other findings, as fermentation, the presence of numerous muscle fibers, free starch granules, and characteristic mucus particles, must be demonstrated. The condition of the intestinal epithelial cells is further of importance for this diagnosis. If they are half digested and the cell nuclei are found in their typical arrangement, the diagnosis of an affection of the ileo-jejunum may, in all probability, be made, whereas degenerated epithelial cells originate usually from the large intestines. They have lost their structure, are opaque and shiny, often wax-like, though the characteristic reaction of the amyloid degeneration is absent.

Catarrh of the Rectum.—Mucus, free from fecal admixture, points to a catarrh of the rectum, of the sigmoid, or of the lower colon. Firm fecal matters encased in mucus, too, point to an affection of the rectum or lower part of the colon, as far as the splenic flexure.

Catarrh of the Upper Colon and of the Small Intestine.—But in absence of mucus a chronic catarrh of the intestines can by no means be excluded. Hyaline clumps of mucus, only to be demonstrated by the microscope, intimately mixed with the firm or pasty stools, point to a catarrh of the colon or jejuno-ileum, though no macroscopic mucus can be detected. If there is a catarrh of the whole colon, the total fecal mass is of a liquid quality and intimately mixed with small shreds of mucus which may be detected by the naked eye.

In the sour jejunal diarrhea, a fermentation dyspepsia with violent

peristalsis, the peculiar, slimy, jejunal contents are evacuated. A closer examination proves the absence of mucus.

Atrophy of the Mucous Membrane of the Colon.—The absence of mucus, with continually soft stools, points to an atrophy of the mucous membrane of the colon; it must be proved in such a case that we do not have to deal merely with an increased peristalsis. A circumscribed atrophy of the intestinal mucosa is not a very rare condition, giving no severe clinical symptoms. The more cloudy the appearance of the mucus, the more severe may be the intestinal affection, as this appearance is due to an abundant amount of leukocytes and epithelial cells.

Pus.—Considerable amounts of pus and blood, together with mucus, point with great probability though not with certainty, to the presence of intestinal ulcers; in dysentery these findings may occur without extensive ulcerations. Pus may be differentiated from cloudy mucus only on microscopical examination. In the common intestinal catarrh, pus is not found in the stools; its sudden appearance speaks for the perforation of an abscess into the intestines, though such a perforation may occur without this finding. In this latter case the point of perforation need not necessarily be very high in the intestine; even the distance from the cecum to the anus is sufficient to so change the pus that it is no longer recognizable in the stool. If pus can be demonstrated undeniably we will exclude common catarrh and think of ulcerative processes, typhoid fever, dysentery, syphilis, tuberculosis, or neoplasms. Especially in chronic dysentery the amount of pus may be very considerable.

Blood.—Blood in the stools may sometimes be seen on mere inspection or on microscopical examination, but sometimes only by the chemical methods. This depends not only on the quantity of the blood poured into the intestine, but also on the localization of the bleeding point and on peristalsis. On violent peristalsis, even duodenal hemorrhages may lead to the appearance of unchanged blood in the stools, whereas, on sluggish peristalsis, hemorrhages in the upper portions of the colon may be detected only by chemical examination of the stools. In general, the rule holds that minute hemorrhages of the colon or lower ilium undergo transformation into hematin. In deep-seated carcinoma of the large intestine, fresh blood, recognizable microscopically, may be present. Not only gastric, but esophageal hemorrhages may leave traces in the feces. In these cases the stools are of a tarry-black color. The lower the bleeding in the digestive tract, the more reddish is the tint of the feces, until finally blood coming from the rectum appears entirely unchanged in the stools (hemorrhoids, rectal carcinoma).

The causes of hemorrhage are, in the first place, all ulcerative

processes of the intestinal canal; further, venous stasis and the severe congestion which develops on invagination. Phthisical patients may suffer from intestinal hemorrhage, though postmortem no changes may be found in the mucosa. Blood mixed with pus or muculent hemorrhagic passages are found in dysentery.

Hemorrhoids and adenomatous polyps and papillomata lead to hemorrhage from the rectum; the two last-named conditions, in contrast to the first-named, are more frequently found in children. Adenomatous polyps may be discovered on rectal examination, while the small rectal papillomata may evade the palpating finger. On examination of the rectal mucosa with the rectoscope, these small ulcerations present themselves as flat, blood-tinged excrescences the size of a pinhead. They may give rise to very troublesome, frequent hemorrhages. Their treatment is not so simple as that of the adenomatous polyp, which may be pressed down by the finger to the orifice of the anus and ligated. The papillomata must be treated with the galvanocautery or with cauterizing substances which are applied under the guidance of the eye.

Of eminent significance for the treatment of carcinoma is an early diagnosis, which unfortunately is sometimes not made through neglect of the digital examination or recto-romanoscopy.

Sometimes slight lesions of the mucosa, produced by the enema point, digital examination, or fissures of the anus, are the cause of slight hemorrhages from the rectum.

Reaction of the Stools

The reaction of the stools in adults is neutral or feebly alkaline. Stomach affections and common enteritis usually exert no influence on this reaction. If the secretion of the pancreas is absent, the reaction may become alkaline, as the splitting up of the fat is hindered. In jaundice, as has been mentioned, we have to expect an acid reaction since the fat resorption is considerably decreased, whereas the splitting of the fat is undisturbed. In typhoid fever, dysentery, cholera, intestinal tuberculosis, and all forms of enteritis in adults an alkaline reaction of the stools is present; an exception is the acid jejunal diarrhea.

In regard to the action of the infants' stools, the normal stool of a breast-fed child is of slightly acid reaction, which is due to a somewhat incomplete fat and carbohydrate digestion, leading to the production of fatty acids by the fermentation of lactose and of high molecular fatty acids from the ingested fat. Protein decomposition is also absent in the stool of the breast-fed infant.

If this acid reaction exceeds the usual degree, we have either a too lively fermentation of carbohydrates or a disturbance of the fat

digestion. A green color and an odor of butyric acid speak for sugar fermentation, whereas these two symptoms are usually absent in fatty diarrhea. If, under pathological conditions, protein putrefaction is present, the reaction becomes alkaline.

The normal cows' milk stool is slightly alkaline, and therefore, when we find an acid reaction, we shall have to think of an especially active carbohydrate fermentation or of an intense disturbance of the fat digestion. A pathological protein putrefaction will announce itself by an increased alkaline reaction.

The examination of the urine also permits us some conclusions regarding the degree and existence of intestinal putrefaction. This will be considered in another chapter.

GENERAL THERAPEUTIC VIEWS

(*a*) **In Adults.**—The stool examinations, therefore, teach us which component of the foods are chiefly affected by the disease of the intestinal canal, and further which component is the cause of the abnormal processes of decomposition and fermentation. It is clear that our treatment will be an appropriate one only if we adapt the food to the circumstances. For badly absorbed nutritive matter is not only an unnecessary mechanical load on the intestine, but at the same time a culture medium for infections, which should, of course, be avoided. It follows, therefore, that where fat digestion has suffered we will supply a diet poor in fat, that where the protein resorption is injured or, what is more easily shown, where the protein produces putrefaction products of abnormal quantity or quality, the supply of albuminous food will have to be restricted as far as possible, and that the carbohydrates must be removed from the diet when processes of fermentation can be found.

Some have gone so far in the prescription of food as to determine the degree of resorption for the various kinds of meat from the stool examination, and from these to choose the one indicated. There are men who cannot tolerate pork or veal or fish; however, according to our opinion, we will have to rely more on clinical observations, as it cannot be expected of every physician to study the histological character of the different meats. Further, there are certain idiosyncracies, as yet not quite understood, which will often have a determining influence in selecting the diet Thus there are patients who tolerate butter excellently and are not harmed by taking a milk-sugar solution, whereas milk produces an increase of their dyspeptic and catarrhal disorders; some, also, who cannot endure milk alone, tolerate it with certain additions, as cocoa or tea, or when fermented (kephyr, kumiss).

(*b*) **In Nurslings.**—Of direct determining significance is the behavior of the different components of the food as to absorption in infancy. In infancy, therefore, we will examine the stool, at least in a rough way, before we prescribe any diet. In the place of crude empiricism there comes a more and more rational therapy, though some questions are still in controversy. If no fresh stool is at our disposal, a small quantity of stool sufficient for examination may be gained by the introduction of a Nélaton catheter into the rectum. Still, Selter believes that such a sample of stool allows of no valid conclusions as to the quality of the spontaneous evacuation, and proposes to introduce into the rectum a soap suppository whereby a stool is obtained from higher portions of the intestine. By this method he obtained sometimes a pathological stool, whereas the sample obtained in the same individual by the Nélaton catheter was of entirely normal quality.

In the fresh stool we first determine its reaction, giving attention, then, as to whether it is firm or crumbly, if mucus is present, and if it is of a greenish color. We will next look for "milk granules," lime soaps, neutral fats, and free fatty acids, using, under all circumstances, the microscopical preparations to confirm our macroscopical findings. We test for starch with Lugol's solution and for sugar by its fermentation products (lactic acid with Uffelmann's or Kelling's test).

In prescribing the diet we will constantly bear in mind the calorific requirement in infants, which amounts to 100 calories pro kilogram body weight. In many cases, however, we will wave the calorie requirement in the interest of the sparing of the intestines, and, indeed, will often have to begin with 30 calories pro kilogram body weight.

Dyspepsia of Breast-fed Children.—If a breast-fed infant receives too little food, it does not thrive and the stools assume a pathological quality. They may be of abnormal consistency, mucoid and greenish, and on a higher degree of inanition, resemble meconium, which, in fact, is a stool of inanition. In these cases we must first determine accurately the quantity of milk taken, by weighing the child immediately before and after nursing.

Much more frequent are the dyspeptic disturbances due to overfeeding. In such cases the physician must insist that the child is nursed only five or six times a day. If this measure does not help, the time of nursing must be regulated under the control of the scales.

If the child does not tolerate breast milk, even in normal quantities, we usually have to do with a fat dyspepsia. In such cases it is sometimes useful to decrease the fat content of the milk by adding to each breast feeding some food poor in fat, as Liebig's soup and

Holland milk. In other cases veal bouillon, a few spoonfuls after each breast feeding, is recommended.

The examination of the human milk for its fat content must not be made in such a way that an indefinite quantity of it is pumped out without taking into consideration the time of removal of the milk and the food ingested by the mother. It has been found that the fat content of the milk increases considerably during the act of nursing, so that on its first sucking the child obtains a milk of about 2 per cent. fat content and at the end of a plentiful meal a milk about four times as fat. Only in those cases where we use a great quantity of milk or a mixture of samples obtained before, during, and after the feeding may a pathologically high amount of fat be used as a determining factor in our therapeutic measures. If we find an average fat content of 4 to 5 per cent. or more, it may be advisable to pump out the milk, centrifugate it in a sterile vessel and give the skimmed milk to the child. However, its preparation is complicated, and if we wish to avoid contamination, the work must be made so carefully that it is only feasible in the great working plant of a hospital.

As far as the carbohydrates are concerned, lactic acid, as a fermentation product of sugar, is found even in the normal stool of the breast-fed child, and therefore it is impossible to draw any conclusions from its qualitative estimation. But it has been affirmed in some cases that an abnormal percentage of sugar in the human milk has caused dyspeptic disorders.

The exact proof of the existence of a protein dyspepsia in breast-fed children has not yet been established.

Sometimes breast-fed children are affected, if instead of milk, colostrum is secreted, as during the menses or a new pregnancy.

Treatment of Severe Dyspepsia of Breast-fed Children.—It will not, in all cases of severe acute dyspepsia, be absolutely necessary to know exactly which constituent of the human milk is the injurious factor, for the breast-feeding must anyway be omitted for a short time in these cases; for twenty-four hours, some weak tea or boiled water, sweetened with saccharin, is given, combined with small doses of calomel. The return to the natural nourishment is accomplished by placing the child at the breast at intervals of about four hours and by shortening the time of nursing, the amount taken being controlled by the scales, to guard against the ingestion of larger quantities than the intestine could take care of.

Dyspepsia of Artificially Fed Infants.—In the dyspepsia of artificially fed children we have, beside the stool examination, another useful method of finding out which component of the food must be considered as the materia peccans. We try the addition of fat, carbohydrates, or proteins, and observe on which addition the child

becomes worse. With this "provocatory" diet, proposed by Selter, we may inform ourselves in a few days, what nutritive constituent must be totally or partially left out of the feeding.

In the slighter forms of dyspepsia in the artificially fed child, as well as in cholera nostras, so frequent in the hot time of the year, we have to deal with a pathological protein putrefaction, recognized by the reaction of the stool and its odor of foul fish. In these forms of dyspepsia the putrefaction usually involves the casein; in severe enteritis, however, also the intestinal secretions. This does not mean that the proteid was primarily the injurious factor or that overfeeding with proteins has occurred. However, a diet, low in proteins will be of use in these cases.

Chronic dyspepsia of the artificially fed child is characterized by the appearance of knobby, very voluminous, whitish stools; it is probable that undigested decomposition products of casein aid in enlarging the daily quantity of stool.

(*a*) *Proprietary Foods Poor in Protein.*—A number of proprietary foods have enabled us to fulfil the indications of a rational treatment. To Biedert we owe certain milk preparations to which cream has been added, and which have been used for years in appropriate cases with great advantage. He has specified the so-called natural cream-mixture in five different strengths, and the so-called artificial cream-mixture with fourteen different proportions of the protein and fat content.

One liter of milk is allowed to stand for two hours in a cool place; the cream, containing about 10 per cent. of fat, is then skimmed off, and three parts of 5 per cent. milk-sugar solution is added to make the first dilution, and 1/2, 1, 2, and 3 parts of milk to form the four following dilutions. Also the artificial-cream mixture, a conserve manufactured under Biedert's control, may furnish a useful substitute for milk, representing a food rich in fat but poor in proteins. In Gärtner's fat-milk the fat content is condensed by centrifugation, which at the same time frees the milk from gross contaminations. Though a definite dosage of fat content cannot be obtained, it often is of good service. Other milk preparations are made by diluting the cream with whey and are predigested by trypsin. Instead of cream, milk may be used and the casein content may be lowered by the addition of whey, as in the milk-whey mixture of Monti. Instead of removing the casein by an extract of rennet, it may be precipitated by CO_2.

Another method of increasing the digestibility of casein consists in the addition of rennet to the milk (v. Dungern). The principle of this method consists in preventing the formation of great casein clumps in the stomach, which furnish great resistance to digestion.

If, by the addition of pegnin (rennet), the milk is coagulated before digestion by a shaking process, a very fine flocculent precipitate may be produced, rendering the casein susceptible to the attack of the digestive juices. This addition of rennet aims to advance digestion in a purely mechanical way and is by no means a "ferment therapy," in the narrower sense of the word. Liebig's soup, too, is a food poor in proteins, but its proper indication is not found in protein dyspepsias but in an intolerance for fat, as it substitutes carbohydrates for fat.

In many disorders until recently considered as proteid dyspepsias Holland milk (buttermilk) gave excellent results, sometimes contrary to all expectation, as it contained a high amount of protein. The theories of its explanation do not belong to this book, but many authors ascribe the result to the high acidity of the milk, to its finely flocculent consistency, and to the changed relation of casein to the soluble proteins in favor of the latter.

Czerny and Keller consider these disturbances as fat dyspepsia, and explain the favorable action of Liebig's soup by its poverty in fat.

In many cases of protein dyspepsia one may dispense with all these preparations and merely dilute the milk with a 6 per cent. milk-sugar solution. If the diarrhea is of a severe degree it will be advisable to use, instead of the milk-sugar, Soxhlet's nutrient sugar, containing equal parts of dextrin and maltose, and displaying, therefore, a more constipating action than Liebig's soup in which the maltose with its known cathartic effect is present in four times as great amount as dextrin, which has a constipating effect. Liebig's soup contains also a considerable amount of vegetable protein, which may be a disadvantage in protein dyspepsia, compared with the nutrient sugar, free from albumin. If the infant has reached the third month of life, one of the numerous children's foods may be given greatly diluted, as a meal soup, whereby it is quite immaterial which preparation we use, as our chief aim is to introduce carbohydrate fermentation and to eliminate proteid putrefaction.

(*b*) *Proprietary Foods Poor in Sugar.*—Sugar dyspepsia leads to acid stools which often have a foamy aspect from the fermentation processes which increase the amount of gas in the stools. In such cases we will give milk diluted with an equal part of water, without the addition of sugar; in this way the sugar content is reduced one-half.

(*c*) *Proprietary Foods Poor in Fat.*—Fat dyspepsia is one of the most frequent and severe disorders, rendering good nourishment of the infant precarious. An excellent preparation with which to feed children suffering from fat dyspepsia or follicular enteritis is Liebig's soup. It is prepared in the following way, according to the prescription of Bendix: "100 gm. wheat flour added in small quanti-

ties is stirred into 1 liter milk. This mixture is heated to the boiling point, with constant stirring to prevent the clumping of the flour, kept boiling for three to four minutes, and then removed from the fire. Then 100 gm. pulverized malt is carefully mixed with 3 1/2 gm. of a 11 per cent. solution of potassium carbonate, 200 gm. water is added, and this solution, with constant stirring, is then mixed with the flour decoction. The whole is put in a double boiler containing hot water and left standing for about half an hour until it becomes thin and sweet by saccharification of the starch; it is then replaced on the fire and heated until the soup begins to thicken, is again removed and stirred five minutes, is again heated and again removed, and this process is continued until it becomes thin and sweet. It is then boiled for several minutes, strained through a fine sieve, and is ready for use." This prescription may not be fulfilled perhaps in every household, and we are therefore indebted to Keller who gave a modification whose preparation furnishes no difficulties: "50 gm. wheat flour are stirred with 3/4 liter of cows' milk and the mixture strained through a sieve. In the second dish 100 gm. malt soup extract or 100 gm. malt extract with 10 c.c. of a 11 per cent. of potassium carbonate are dissolved in 2/3 liter water at a temperature of 50° C. The malt-extract solution is then mixed with the milk and flour, and the whole is then boiled. Löflund's malt-soup extract may be used for the preparation of the soup."

[An excellent preparation of Löflund's malt extract is placed on the market by Burroughs, Wellcome & Co., London.—*Editor's note.*]

Czerny places this preparation above buttermilk, because it contains two carbohydrates, which substitute the fat. Buttermilk, which for a long time has been used in its original home (Holland) as a common food for infants, has been recently introduced into other countries through the warm recommendation of Ballot, de Jager, Teixera de Mattos, and Sperk. Buttermilk is a sour milk, rich in carbohydrates and poor in fat. It is very essential to have unobjectionable buttermilk if good results are to be obtained.

According to Bendix, buttermilk is prepared in the following way: 15 gm. of finest wheat flour are stirred up in the cold with a few tablespoonfuls of buttermilk, then made up to 1 liter with buttermilk, and after adding 60 gm. sugar this mixture is slowly heated with constant stirring for twenty minutes. The milk is allowed to boil up three times, is poured while hot into sterile bottles carefully closed, and placed in a cold place.

If it is hard to get good buttermilk, preserved buttermilk may be tried. As soon as the stools have regained their normal quality we may try to return to normal milk, but only with the greatest care, as especially in fat dyspepsia slight additions of fat may produce

anew severe disorders. In the treatment of the dyspepsia of artificially fed children the best thing to do, if at all possible, is to give the children the breast again. Only in fat dyspepsia will this not be desirable, unless it is possible to give skimmed human milk, as may be the case in a hospital. Or we may give human milk and buttermilk together, perhaps 2 tablespoonfuls of the latter to each breast feeding.

Atrophy of Infants.—In atrophy of infants a bad resorption of food is often present, though the stools are apparently normal. In this chronic affection we do not have to deal with great differences in the resorption coefficient, and nevertheless an increase of weight is wanting, and even a loss of weight may occur. Here, more than in all other diseases of the intestinal organs, we must insist on the supply of human milk. That Moro has proved that the weight curve is unfavorably influenced, all other conditions being equal, even in children nourished with human milk, if this is given in a boiled condition, explains the fact that in atrophy we never obtain such splendid results with sterilized or pasteurized milk as with native mother's milk. The use of unboiled animal milk (raw fresh goats' milk) may give excellent results in some cases of atrophy.

Diarrhea in Older Children.—In the diarrhea of elder children the conditions are usually similar to those of adults. The treatment of the diarrhea in adults has been discussed in detail in the previous chapter; here it will only be mentioned that also certain forms of diarrhea in adults demand special diet. In jaundice and in other digestive diseases we may have to deal with a certain intolerance for fat, especially the fat of a higher melting point, such as that in our common food; in this case it must be excluded. Butter may still be tolerated in small quantities, but in jaundice its use is absolutely contraindicated. Of all kinds of fat, only that of milk is then suitable, provided there exists no idiosyncrasy against its use. The existence of protein dyspepsia in adults has as yet not been demonstrated clinically; the carbohydrate and fat dyspepsias appear as the sour jejunal diarrhea; in these by decreasing the carbohydrates, especially the sugars and also the fruit acids, good results may be obtained, especially if combined with intestinal disinfectants (resorcin, menthol).

BACTERIOLOGY OF THE FECES

The bacteriology of the feces is of great importance for the internist and for the pediatrician. We shall not speak of the cultural methods, which cannot be made immediately at the sick-bed, but only point out how essential the finding of cholera, typhoid, dysentery, anthrax, pest, and tubercle bacilli in the stool is for our whole concep-

tion of the morbid condition. As far as tubercle bacilli are concerned, we must constantly bear in mind that they may have been swallowed with the sputum. To the finding of protozoa in the stool great significance has been attributed. However, the question of dysentery ameba is not yet solved. They resemble the amebæ found under normal conditions, but nevertheless they must be differentiated from them.

If we inject the stool of amebic dysentery into the rectum of a cat, the same disease is reproduced, with living amebæ in the stools. The normal Amœba coli, on the other hand, is not pathogenic for cats.

Amebic dysentery is to be distinguished clinically as well as anatomically from the bacillary dysentery by the following considerations (Kernig and Ucke):

1. The submucosa of the large intestine is severely involved.
2. A tendency to the formation of liver abscess.
3. To chronic course.

According to Epstein, the finding of amebæ and the clinical manifestations go parallel.

The Balantidium coli has probably not the faculty to form toxins, but it produces obstinate diarrhea from local irritation. (Koessler.)

In the bacteriological stool preparations of infants a great difference is found normally between breast- and artificially-fed children. If we fix the native preparation and stain it according to the Weigert-Escherich method, it may be determined even by the naked eye that the human-milk stool contains chiefly blue bacteria, the cow-milk stool chiefly red ones; the cow-milk stool is characterized by a very various flora, but not as various as that in adults.

These normal intestinal bacteria offer a protection against invading bacteria, and if infection has taken place, as, for instance, with dysentery, the normal bacteria disappear almost entirely or entirely from the stools, so that in plate culture scarcely one colony of B. coli can be found if the dysentery infection has reached its height. In the same measure as the infection heals the normal inhabitants of the intestines reappear. The coli bacilli are said to have the faculty of becoming virulent under certain conditions and to lead to certain severe infections of the intestine, peritoneum, and bladder, and even to a severe septicemia. Escherich, however, does not believe that the coli colitis is due to the transformed normal inhabitants of the intestines, but to other coli strains introduced from without. Sometimes other inhabitants of the intestine may become virulent, as B. proteus and B. pyocyaneus.

In general, it may be said that in the diarrhea of infants the Gram-positive, blue bacilli disappear, and mostly red, Gram-negative bacilli are found, in the native preparation as well as in culture. An excep-

tion is the blue bacillosis of Escherich. Salge reports similar findings. His acidophile Gram-positive bacilli decompose oleic acid into lower fatty acids, producing in this way a sort of fat dyspepsia on an infectious basis. Moro could demonstrate in children overfed at the breast a staphylococcus enteritis, Escherich a streptococcus enteritis.

To differentiate all these different infectious intestinal diseases is of no therapeutical interest, except in the case of infection with the dysentery strains of Flexner, Kruse, and Shiga, against which we have a specific therapy. We must constantly bear the fact in mind, that when we have to deal with an infection of the intestinal wall the nourishment of the patient must be of chief importance, since we have to aim to improve his strength and to stimulate the formation of antitoxins; the stool findings as yet do not give us any aid in choosing the diet. In such cases we have no cause to assume a disturbed resorption elective for the one or the other components of the food, but must assume a generally injured faculty of resorption, augmented still more by increased peristalsis. Nevertheless, in choosing the diet, we must to a certain degree take into account the biological conditions for the development of intestinal bacteria. In this consideration we will omit one or another component of the food in order to render unfavorable the condition of growth for the bacteria, not in order to avoid an injurious food rest. Thus the removal of fat is of favorable influence in blue bacillosis. Still more pronounced is the relation of infection to a certain component of the food, the starch in the iodophil bacteria (Salge). These bacteria are stained blue or brown by Lugol's solution, and are chiefly found in children fed with floury foods. Their occurrence is intimately connected with an insufficient absorption of carbohydrates, especially of starch, but also of sugar; and therefore, if present, they furnish the indication to remove the starch at least from the food.

The fact that breast-fed children are much more resistant against infection than those artificially fed, further, that, as has been repeatedly shown, the bactericidal power of the blood serum is incomparably higher in those naturally fed, makes the demand for human milk most urgent whenever it may be obtained. In these cases laxatives must not be used, on account of the weakening which follows the use of these drugs, since it is not the question here of removing harmful ingesta from the intestines.

CHAPTER XIII

HEMORRHAGE

GENERAL REMARKS

By hemorrhage we understand the effusion of blood from a vessel, whether into the tissues, on a free surface, or into preformed hollow cavities.

a. **Division According to Aspect.**—According to its aspect, we distinguish the following hemorrhages into the tissues: Ecchymoses, petechiæ, suffusions, sugillations, hematomata, and hemorrhagic infarcts.

b. **Division According to Localization.**—According to localization of the bleeding, we distinguish epistaxis, hemoptysis, hematemesis, melena, hematuria, metrorrhagia, hematothorax, hematopericardium, hematometra, hematocolpos, hematocephalus, apoplexia cerebri, uteri.

c. **Division According to Kind of Blood.**—According to the content of oxyhemoglobin, arterial and venous hemorrhage are distinguished. A mixture of both kinds of blood occurs in capillary or parenchymatous blood effusions.

d. **Division According to Extravasation of Blood.**—Extravasation of blood may occur in different ways:

1. Through rupture of a vessel (per rhexin).
2. Through gradual erosion from without (per diabrosion diaeresin).
3. Through emigration of the blood-cells through the vessel walls (per diapedesin).

Per Rhexin.—Rupture of the vessel may be due to trauma, as puncture, gunshot wound, pointed foreign body, sharp concrements formed within the body, or to the coaction of morbid changes in the vessel walls with increased blood pressure; either one of these two factors alone is rarely sufficient to produce the rupture of a vessel, though it seems that the admixture of blood with the effusing serum in the blood-filled vesicles, often found after the use of dry cupping glasses, is caused only by a difference of pressure. The tendency to hemorrhages at great altitudes (high mountains, balloons) may probably, too, be explained without changes of the vessel walls. However, it is possible that we have here to deal with a hemorrhage per diapedesis and not per rhexis.

Circulatory disturbances produced by evaporation and loss of water from the blood in other ways may perhaps play an important part.

The pulmonary hemorrhages of the caisson-workers may be mentioned, though they do not exactly belong here; they develop from a too rapid lowering of the increased pressure to the normal. Heller, Mager, and v. Schrötter consider the escape of free nitrogen and the formation of gas emboli as the immediate causes of the hemorrhages, which are falsely attributed to the suddenly lowered pressure.

Pressure differences alone do not commonly lead to hemorrhage if the vessel walls are intact. On the other hand, it is undeniable that with normal blood pressure, as in a state of complete physical and mental rest (as in sleep), severe hemorrhage may occur if the vessel walls are diseased. Daily experience teaches that people may waken with nose-bleeding; cardiac callosities and aneurysm, miliary aneurysm of the cerebral arteries or those in tubercular cavities, as well as large aneurysms of the aorta, may lead to fatal hemorrhage during sleep, though no sudden increase of blood pressure could be supposed as the moment of rupture. It must, however, be conceded that the blood pressure is constantly increased by a pathological process in many of these cases, as arteriosclerosis, granular kidney, aortic insufficiency, idiopathic hypertrophy of the heart.

The danger of the rupture of a vessel is, of course, very much increased by a rise in blood pressure, and is therefore not rarely observed immediately following physical exertion or mental emotion. A gradual abrasion of the vessel wall is frequently observed in typhoid ulcers, tubercular cavities, and peptic ulcer of the stomach. The severe hemorrhages may be here preceded by small and even minute bleedings, which are of greatest importance as premonitory symptoms.

Per Diapedesis.—Hemorrhages by diapedesis never occur from arteries, since even the smallest of them have a relatively thick wall. They are capillary or venous hemorrhages, occurring chiefly on increased blood pressure, though they may also be incited by different noxæ injuring the delicate vessel walls.

Following the presentation of this subject in Lubarsch's "General Pathology," Vol. i, we distinguish five groups of pathogenetic conditions for hemorrhage per diapedesin:

1. *Through Stasis.*—Stasis leads to small petechiæ, especially on the serous membranes, thus on the epicardium the well-known Tardieu or Bayard spots, a finding important for the diagnosis of deaths from suffocation, which clinically give no symptoms. Chronic congestion, acting through small extravasations of blood and the transformation of hemoglobin, leads to the brown induration of the organs, well known to the pathologist ("heart-disease cells" in the sputum on cardiac insufficiency).

2. *Through Vascular Obstruction.*—If a vessel is obstructed by an embolus or thrombus, hemorrhages are frequently observed. Thus a very abundant hemorrhagic effusion is found in the peritoneal cavity on thrombosis of the portal vein. Also hemorrhagic infarcts, especially of the lungs, belong here.

Multiple pinhead hemorrhages are frequently found on the skin, the mucous membrane, and in the parenchyma of the various organs in those cases where numerous small emboli may be produced. Fat and parenchyma cell emboli, following trauma, small thrombi, following burns, freezing, certain intoxications (ergot), and coccus emboli in septicemia and pyemia produce such hemorrhages. In the last case they are not necessarily connected with the mechanical obstruction of the vessel from bacterial agglutination, but we have to deal, probably, with an infectious and toxic origin of diapedesis.

3. *Through Infectious Processes.*—There exists a certain connection between the hemorrhage and the nature of the infective agent. Pure streptococcus infections lead most readily to it, as in erysipelas, sepsis, and puerperal processes, as well as in mixed infection with diphtheria, scarlet fever, small-pox, and typhoid. The hemorrhages are localized on the skin, mucosæ, and on the retina and internal organs; in malaria there is a predilection for the brain.

Less frequently, hemorrhages are found in staphylococcus infections or in colon septicemia, though the rarely observed Winckel's disease is probably nothing else than a B. coli sepsis proceeding with the picture of a severe hemorrhagic diathesis.

Of importance is the tendency to hemorrhage developing sometimes in the course of chronic tuberculosis, which leads to the conception of a tubercular hemophilia. To this group of hemorrhagic diseases *in sensu strictu* belong further ulcerative endocarditis and probably leukemia, though the final proof that we have to deal with an infection is still wanting. Toxic infections, *i.e.*, not produced by bacteria themselves, but by their toxins, are the hemorrhages in the course of a pure Loeffler bacillus diphtheria and in tetanus. In Möller Barlow's disease it is still undecided whether the hemorrhage has to be considered as infectious, toxic, or autotoxic.

4. *Through Toxic Effects.*—Certain poisons have the faculty of leading to local or general hemorrhages. This effect is best known in intoxication with phosphorus, which produces numerous small hemorrhages on the mucous and serous membranes. The same symptom may be found, though not so constantly, in intoxication with carbon monoxid. Potassium iodid is said to have this property only on the pathologically changed vessels of syphilitic patients, morphin only in a very far advanced morphin cachexia, where the skin is no longer normally nourished.

The hemorrhagic infiltration which snake venom produces in the circumference of the bite may here be mentioned; hemorrhages in the internal organs and on the serous membranes may develop at the same time. A typical toxic bleeding is that frequently observed in grave jaundice. In some cases of sciatica, bleeding into the nerve sheaths has been observed, and this, like the sciatica itself, has to be considered as toxic.

5. *Through Neurotic Influences.*—Hemorrhage produced by nervous influences is a field which has been considerably restricted recently, as compared with earlier times. It cannot be denied that vicarious menstruation may be observed, as bleeding from the nose, gums, external auditory meatus, and the lungs. In part we have to deal probably with the simulation of hysterical individuals; the vicarious hemoptysis will be observed almost constantly with phthisis.

In the cutaneous hemorrhage of hysteria, trauma produced with intention certainly plays a great rôle, as well as coexisting severe constitutional abnormalities, as chronic nephritis and pernicious anemia. Here belongs the development on the skin of blood-filled vesicles and hematidrosis whereby we understand blood extravasations from the concomitant vessels into the efferent ducts of the sweat glands. This latter symptom is looked upon very skeptically by serious investigators. In the hysterical hemorrhages of elder women, arteriosclerotic changes of the vessel walls are of importance, together with the raised blood pressure due to the hysterical affection. Very exceptional cases of chronic neuroses have been reported, in which angioneurotic edema and cutaneous hemorrhage interchange, as in purpura. A very obscure field is that of the "essential" hemorrhages, from the esophagus, stomach, kidneys, etc., without any anatomical findings. Especially striking is the occurrence of a unilateral renal hemorrhage; this speaks against the presence of a hemorrhagic nephritis, which is almost constantly bilateral.

Authors who consider hemophilia as an inherited, morbid permeability of the vessel walls and as an insufficient functional capacity of the vasomotor nerves (angioneurosis) will class this condition also in this rubric.

COURSE OF HEMORRHAGE

The human organism possesses means of decreasing the dangers of hemorrhage. In severe hemorrhage on the free surfaces the arrest of the bleeding is automatically introduced by two factors:

1. The blood pressure sinks in the opened vascular region.

2. The time of coagulation is shortened, in this way a thrombus may develop in the wound, arresting the bleeding like a tampon. A

danger which may be compensated to a certain degree lies in the fall of the blood pressure in the general circulation. The vessels contract to maintain the necessary flow; animals maintain their circulation even after losing 2/3 to 3/4 of their total quantity of blood (Kronecker); if the adaptation of the vessels ceases, the big vessels remain entirely relaxed, while the small ones contract energetically, rendering the absence of a sufficient blood supply more intense. The loss of 1/2 liter blood in adults usually leads to syncope; after the loss of 1 1/2 liters death may occur.

That in death from bleeding it is not, in the first place, the loss of oxygen carriers, but the insufficient filling of the capillaries in vital organs which kills may best be seen from the frequent life-saving effect of salt infusions, which certainly are no gain for the tissue respiration. Hemorrhages, then, become dangerous when they are abundant; or when small, if uncontrollable; or if they are constantly repeated at short intervals.

A considerable danger lies, further, in the secondary manifestations of chronic anemia if it leads to fatty degeneration of vital organs, as of the heart, or if it injures the hematopoietic organs so severely that a vicious circle, the progressive pernicious anemia, is produced. The interruption of the circulation by obstruction of the bleeding vessel is usually of no significance, as soon the collateral circulation becomes established. If the organ to be supplied is so sensitive that it cannot, even for a short time, tolerate an insufficient blood supply without harm, some clinical manifestation may result (ligature of the common carotid).

A hemorrhage may become dangerous through its localization, though the amount of blood lost may in itself be insignificant. This is true of all hemorrhages which increase intracranial pressure, as a hematoma of the dura, apoplexia cerebri, etc.; also of all blood extravasations into the pancreas, the adrenals, heart muscle, etc.

After an extensive hemorrhage, the amount of blood lost is better regenerated than after repeated small hemorrhages, the first acting as a vigorous stimulus to the hematopoietic apparatus, while the latter exhausts rather than excites it. The blood effused into the tissues is removed into the regional lymph glands, in which the more or less changed blood coloring matter may be recognized. The blood effused into serous cavities is resorbed very slowly, often remaining liquid and unchanged for a long period of time.

GENERAL TREATMENT OF HEMORRHAGE

Surgical Arrest; Ligature.—The sovereign hemostatic of modern surgery is ligature of the bleeding vessel at the point of injury, as well as in its continuity. Torsion and pressure are used only exceptionally.

Compression.—Of great importance, especially in sudden accidents, is compression. It is employed most frequently in the form of a compressing bandage of aseptic gauze and is chiefly a provisional means of arresting hemorrhage, though it is used also as a definitive hemostatic: tamponade in epistaxis and in hemorrhages into the rectum or into the female genital tract. After all, the arrest of hemorrhage by exact suture is, in fact, nothing else than pressure action.

Digital compression of the afferent artery or its compression with tourniquet, rubber bandages, or by forced flexion of the joints in lesions of the flexor surfaces will have to be considered in severe hemorrhage when immediate surgical intervention is not possible, as on the battle-field.

Elevation.—The arrest of hemorrhage is much furthered by elevation, and secondary hemorrhages are thereby usually avoided.

Thermocauterization.—In hemorrhage of vessels too small to be ligated, thermocauterization is often an excellent method. The heat should be the weak red heat, never the white heat, as the first gives the better results.

Ice-water; Hot Water.—Cold is a good styptic, acting through the contraction of the small vessels. Moderate heat also (water at 45° C.) which acts hemostatically by hastening coagulation.

Chemical Hemostatics to be Applied Locally.—A series of chemically acting substances has been advocated as hemostatics, thus liquor ferri chloridi, with which cotton is saturated and pressed on the bleeding point for several minutes. Another less caustic remedy is a 2 per cent. carbolic acid solution, which is best used to arrest parenchymatous hemorrhage at a temperature of 50° to 60° C. Antipyrin in 20 per cent. solution or as powder, ferropyrin, containing 12 per cent. iron and 64 per cent. antipyrin, used in the same forms, and styptol, are characterized by the absence of any cauterizing action. A fibrin ferment solution with a 1 per cent. calcium chlorate solution (Wright) and also thrombokinase give equally good results. Cocain solutions of 15 to 10 per cent. act as styptics on mucous membranes, not only anesthetizing them, but also rendering them anemic. In hemorrhages of the oral cavity, as after the extraction of teeth, mouth-washes, with the addition of vinegar, alum, or tannin, are generally effective.

Hemostatics Acting Indirectly.—There is a series of preparations which enjoys, with more or less right, the reputation of acting as styptics on internal, subcutaneous, or rectal application. If we disregard, at first, the most modern methods of treatment, by gelatin, horse serum and adrenal extract, there do not remain many effective remedies.

Ergot.—Ergot (secale coruntum) and its active principles, as ergo-

tin, cornutin, etc., produce a stimulation of the vasomotor center, and through irritation of the vasoconstrictors, an increased pressure and, at the same time, vigorous contractions of the uterus; for this latter action it is used in atonic metrorrhagia; and by the first-mentioned action, it is believed to influence pulmonary, gastric, intestinal, and renal hemorrhages. From the theoretical point of view, objections have been raised against the advisability of this medication. For increased pressure in the vascular system is not desirable in hemorrhage, the more, as all vessels with normal musculature probably produce more energetic contractions than those from which the bleeding occurs, whose wall is usually severely changed (aneurysm in a tubercular cavern with hemoptysis). However, practical experience is not always in harmony with this theoretical consideration. The use of ergot in metrorrhagia is doubtless successful; in pulmonary hemorrhage, however, its action is not reliable—something readily understood as the pulmonary vessels have no nerves—which limits the action of the ergot to the systemic circulation. Ergot is prescribed in powders of 0.3 gm. at intervals of a quarter of an hour (maximal dose 1 gm., *pro die* 5 gm.), or as the infusion of 3 gm. ergot to 100 of water, given in tablespoonful doses or as enema. The extract of ergot (ergotin) is given in doses of 0.1 to 0.3 gm. (maximal dose 0.5 gm.; *pro die* 1.5 gm.).

Huchard prescribes his "hemostatic pills" in the following way:

Rp. Ergotin.,
Chinin sulfur., āā 2.0
Pulv. fol. digital.,
Extr. hyoscyami, āā 0.2
M. f. pilul. No. XX.
DS. 5–8–10 pills daily.

Nothnagel recommends:

Rp. Extr. secale cornut., 5.0
Aq. destill., 15.0
Acid carbol., 0.1
1/2–1 Pravaz syringe once or twice a day.

Best adapted for subcutaneous application are the ergotin preparation of Bonjean, Bombelon, or Wernich in the above given doses.

Hydrastis Canadensis.—Hydrastis canadensis (golden seal) is used in a similar way. Of the fluidextract, 20 drops are given internally every three hours; hydrastinum hydrochloricum may be used in 10 per cent. solution, 1/2 to 1 Pravaz syringe being given.

Similar is the indication for stypticin, a narcotin derivative, of which, in 10 per cent. solution, 1 to 2 Pravaz syringes may be injected daily into the gluteal muscles, or it may be taken internally in the form of Merck's tablets, containing 0.05 gm. up to five times a day.

Its constant use over a long period has proved successful in some cases of hemorrhagic choroiditis. However, its chief domain is gynecology.

Quite useless and, in fact, abandoned by the greater number of physicians, is the internal use of local styptics to produce distant styptic action. It cannot be understood of what use a few drops of liquor ferri chloridi taken by the mouth could be against a severe hemoptysis. Probably the same is true of the influence of tannin preparations in the kidney and bladder hemorrhages. In opposition to this, Wallis and Parry praise the administration of calcium chlorid, especially in hemophilia; it may be given in powders 1 gm. three times a day or as enemas, 50 gm. of a 10 per cent. solution (Senator).

The last years have enlarged our therapeutical possibilities by the addition of two hemostatics, gelatin and adrenal preparations.

Gelatin.—Gelatin has been used as a styptic in China since the oldest time. Curschmann was the first outside of China to recommend it, and it has been very much praised by various authors in the last few years. Hemorrhages which resisted all other treatment were promptly arrested by gelatin, and it cannot be considered as an accident that Holtschmied in one year healed all five cases of melena neonatorum which were observed in the Dresden gynecological clinic, by the injection of gelatin, whereas up to this time the mortality had amounted to 50 per cent. Gelatin is used in a 5 to 10 per cent. solution locally, as per rectum, or subcutaneously. The internal use demands no special precautions; however, it spoils very quickly and must therefore be kept in a cold place and liquefied before use by warming.

Rp.	Gelatin purissim.,	10 gm.
	Aqu. destill.,	160
	Syrup rub. Id.,	20
	One tablespoonful every hour.	

To avoid fermentation processes it may be sweetened with saccharin instead of sugar. Ten to 30 c.c. of a 2 to 5 per cent. solution are used for injection.

Disagreeable accidents at first discredited the gelatin injections; tetanus infections have occurred, which can only be avoided by sterilizing the gelatin for one-half hour in the autoclave on five consecutive days, on account of the high resistance of the tetanus spores (P. Krause). Gelatin which is thus sterilized is placed on the market by Merck in phials containing a 2 and a 10 per cent. solution, ready for use. Other accidents, which may follow gelatin injections are painful infiltrations, abscesses and gangrene of the skin, and even hmeoglobinuria and nephritis. In a patient with nephritis we preferably refrain from the subcutaneous use of gelatin.

Adrenal Preparations.—Since Oliver and Schäfer, in 1894, discovered the powerful action of the suprarenal extract on the vasoconstrictor nerves, various preparations of the suprarenal gland have in recent years been introduced into the pharmacopeia. The preparations, according to their manufacturers, have different names, as adrenalin, epinephrin, suprarenin, tonogen, renoform, etc., they are all of equal power, and used in the dilution of 1 : 1000. For the internal use one gives 10 drops three times a day of the 1 pro mille solution. Abderhalden and Bergell consider the epirenan as the purest preparation of the suprarenal glands, and recommend it in doses of 15 drops of the 1 : 1000 solution every three hours.

Normal Serum as Hemostatic.—Weil and Clerc first called attention to the styptic action of normal horse serum injected subcutaneously. Numerous observers have confirmed this observation. Especially in melena neonatorum, but also in various other forms of hemorrhage (ulcer of the stomach and duodenum) its hemostatic effect surpasses that of all other styptics known; 5 to 20 c.c. may be injected repeatedly. (Caution serum disease and anaphylactic shock!) (Koessler.)

Infusion of Physiological Salt Solution.—When the hemorrhage has been arrested, the necessary volume of liquid must be recovered, if danger threatens, to maintain the circulation. This is best accomplished by the infusion of physiological salt solution, of which up to the thirty-fifth part of the body weight of the patient may be incorporated without any harm. In general 1/2 to 1 liter will be sufficient for adults, 100 to 200 c.c. for infants. Still more effectual is the intravenous infusion. Under the strictest aseptic precautions sterile physiological salt solution, previously warmed to 38.5° to 39° C. is injected into a vein of the arm. The infusion should last half an hour; the filling of the heart with salt water must be avoided.

The rectal injection of physiological salt solution, with or without the addition of sodium saccharate (2 to 5 per cent. solution) is an excellent treatment of postoperative hemorrhage.

Autotransfusion.—By wrapping the extremities with elastic bandages and placing the head low, the whole quantity of blood to be disposed of may be used for the nourishment of the vital centers—autotransfusion. When this procedure is to be interrupted the bandages must not be loosened on all four extremities at the same time; this would produce a cerebral anemia, since the blood would suddenly rush into the freed vascular regions.

VARIETIES OF HEMORRHAGE

Epistaxis.—Nose bleeding may be a very insignificant symptom, but it is also one to be taken seriously. From the amount of blood

lost it is rarely dangerous, except when we have to deal with a constitutional anomaly which may lead to severe hemorrhage. Epistaxis may be a symptom of a severe affection; thus it may be observed after fracture of the base of the skull involving the lamina cribosa. We divide epistaxis, according to its pathogenesis, into three groups:

1. Epistaxis with pathological findings in the nose.
2. Epistaxis from circulatory disturbances.
3. Epistaxis with general tendency to hemorrhages.

Etiology.—To the first group belongs the traumatic ulcer of the nasal septum, frequently found in habitual picking of the nose; also trauma of the nose, leading to laceration of the mucosa or to fracture of the cartilage or bones; and lesions produced by pointed foreign bodies or by catheterization of the Eustachian tube, etc. Of inflammatory processes nasal diphtheria is more frequently associated with a bloody, serous secretion, often, however, with real nose-bleeding. It is often found in acute and chronic rhinitis and in scrofula and syphilis of the nasal structures, in nasal tuberculosis, lupus, polyps, adenoid vegetations, hypertrophies of the mucosa, and exulcerating neoplasms.

Of interest is the nose-bleeding frequently noticed before the eruption of the rash in measles. Pfaundler believes that we may have to deal here with the eruption of an exanthem. But this form of epistaxis may perhaps belong to the second group, for it is frequently observed in the prodromal stage of other acute infections, as typhoid fever, influenza, pneumonia, etc., where it is due to the febrile congestive hyperemia.

In chronic diseases leading to increased blood pressure, epistaxis is frequently found occurring in repeated attacks, as in chronic nephritis, granular kidney, idiopathic cardiac hypertrophy, arteriosclerosis; further, in the circulatory disturbances of puberty, as vicarious menstruation and due to congestion.

The congestion may be general, as in pertussis, cardiac and lung diseases, or involve only the upper half of the body (compression of the veins which lead the blood from the head, through tumors or a too narrow shirt collar), or may only hinder the venous flow from the nose, as in thrombosis of the longitudinal sinus.

The third group comprises certain constitutional diseases, as hemophilia, chlorosis, pernicious anemia, leukemia, and pseudoleukemia, and the large group of the different hemorrhagic diatheses; further, the severe septic conditions, occurring primarily or as complications of diphtheria or scarlet fever. The cause and, if possible, the localization of the hemorrhage have to be discovered. Epistaxis occurring during sleep may simulate hematemesis or hemoptysis if the blood flows backward. It is checked in the simplest way by the

anterior tamponade with a cotton pledget. If this is not at hand, the *ala nasi* of the bleeding side is pressed against the septum for several minutes. If the bleeding point can be seen it may be cauterized with the silver nitrate pencil. Cotton dipped in chlorid of iron or adrenalin, in a solution of 1 : 1000, or ferropyrin, and in severe cases injections of gelatin are the usual measures, and they generally render the tamponade of the nares by means of Bellocq's cannula unnecessary. This tamponade, if needed, is performed in the following way:

Bellocq's Cannula.—Bellocq's cannula is introduced into the bleeding nasal cavity closed, so that it touches the posterior pharyngeal wall with its button. The spring is then allowed to snap out and become visible in the oral cavity. The tampon with two threads attached to it is now adjusted, corresponding in its size to the choana.

The spring is now drawn back into the cannula and the instrument removed from the nose, so that one thread of the tampon hangs out from the nose. One now pulls on this thread with the left hand, while the right hand pushes the tampon behind the soft palate; in this way the tampon is inserted in the posterior nasal orifice. The second thread hangs out of the mouth. After the posterior tamponade has thus been performed, the anterior must be accomplished, whereby the thread hanging from the nose is strongly stretched. The tampon may remain in place from one day to, at the most, three days; if left longer, putrid suppuration, otitis, and phlegmons may develop.

Gastric Hemorrhage and Vomiting of Blood.—(*a*) HEMOPTYSIS AND HEMATEMESIS.—Hematemesis is found after hemorrhage of the esophagus, stomach, or duodenum or if blood, originating from nose, pharynx, or respiratory passages, has been swallowed.

As the physician is only rarely present during the hemorrhage, and, therefore, has to rely on the anamnesis given by the excited friends of the patient and on the finding of blood, it is sometimes rather difficult to decide whether he has to deal with hemoptysis or hematemesis, for the patient may cough, even in gastric hemorrhage, from aspiration of the violently expelled blood; and, on the other hand, vomiting may be produced in a profuse hemoptysis, from the severe irritation of coughing. The previous history, speaking in one case for gastric ulcer and in another for pulmonary phthisis, allows us to recognize the origin of the bleeding in most cases. Also the sputa expelled after a pulmonary hemorrhage by the late coughing spells is almost never completely free from blood traces.

Pulmonary blood is very arterial, bright red, foamy, and of alkaline reaction. Blood from the stomach is discolored by the gastric juice to a blackish-red or brown and has an acid reaction. However, pulmonary blood from caverns may be coagulated and gastric blood may be unchanged and arterial if it remains only a

short time in the stomach. The secretory conditions in the stomach, too, play an important part.

(*b*) General Etiology.—The causes of hemorrhage from the above-mentioned portions of the gastrointestinal tract are very various. Peptic ulcers of the stomach, esophagus, and duodenum are frequently observed; then very small erosions must be considered, the size of which is small out of all proportion to the amount of the hemorrhage; exulcerating carcinoma, embolic processes, septic infections, intoxications and autointoxications, portal stasis and varices, finally aneurysms coalescing with the stomach, are all conditions which may lead to gastric hemorrhage. Sometimes a "gastric hemophilia" of unknown origin may develop. Postmortem examinations of fatal gastric hemorrhages, with completely negative anatomical findings are reported.

(*c*) Ulcer of the Stomach.—The formation of the peptic ulcer of the stomach occurs chiefly during middle age and is more frequent in women. Chlorosis seems to give a certain predisposition. Children are attacked only in rare cases.

Pure hematemesis is scarcely ever present in carcinoma, which is only rarely observed before the fortieth year of life. The carcinomatous cachexia and the chemical examination of the stomach contents will in most cases lead to the right diagnosis.

Hematemesis and perforation are the most dangerous complications of peptic ulcer. Two to 5 per cent. of all cases die from immediate consequences of the hemorrhage and of these four times as many men as women. Occasionally recovery is observed even in most severe cases, as in one, reported by Hoffmann, where 4 liters of blood were vomited. An unfavorable prognostic symptom is the fever following a gastric hemorrhage (gastrorrhagia of Soupault).

Occult Gastric Hemorrhage.—Occult gastric hemorrhages are those in which blood is demonstrable in the stools only by chemical means (Boas). The tests commonly used are so sensitive that even 0.0008 gm. blood can be detected.

The guaiac reaction is positive, according to Weber, even after the ingestion of 0.3 gm. raw meat. Therefore, the ingestion of meat will be prohibited absolutely for days if the stools are to be examined for blood. Schloss, in Boas' polyclinic, published a series of stool examinations for occult hemorrhage which permit the following conclusions: Blood is never found in the stool in an acid and subacid gastritis, in hyperacidity, hypersecretion, and benign dilatations. It is found sometimes in gastric ulcer, and in the pyloric stenosis resulting from it. It is found constantly in carcinoma, even on most careful diet. In duodenal ulcer blood may be found in the stools.

Treatment.—The treatment of gastric hemorrhage is identical in

lighter cases with the treatment of the ulcer itself, rest and diet being the most important factors. The patient is put to bed and all food is withheld until the hemorrhage is arrested. At this time nutrient enemas may be given, though thirst enemas may suffice for several days (300 gm. physiological salt solution given four times in twenty-four hours). Then carefully diluted milk, and later on pure milk is given in quantities increasing up to 3 liters a day, amounting to a daily supply of 2100 calories. The addition of a mild alkali, as bicarbonate or phosphate of soda, will be found desirable.

Milk soups with flour (1 to 2 tablespoonfuls flour to 250 gm. milk) may be given to increase the calorific value of the food and to reduce the total quantity of the liquid. Also tapioca, rice, children's foods, nutrose, plasmon, Leube-Rosenthal's meat solution, somatose, etc., may be used in addition. In the following week nothing is changed in the diet, if the typical ulcer treatment, as advocated by Leube and Ziemssen, is carried out. Only zwieback may be added, which is best softened in hot milk. If the spontaneous pain and the sensitiveness to pressure and percussion have ceased, one may begin to give meat in the third week, 100 gm. finely hashed at first, once a day, later on twice. In the fourth week different kinds of meat, vegetables in purée form and compote may be added. Unhashed meat should not be taken for two months.

Lenhartz, considering the Leube-Ziemssen treatment too severe, advocated from the beginning a diet rich in proteins, in order to combat at the same time the hyperacidity and the hyponutrition. On the day of the hemorrhage he gives 200 to 300 c.c. ice-cold milk; at each dose not more than a tablespoonful; later on he increases the quantity of milk 100 c.c. every day until 1 liter is reached. On the second day a raw egg, beaten and cooled on ice, is given; one egg is added daily, until eight are given. On the sixth day he begins with hashed raw meat, which is gradually increased. The patient receives milk rice on the seventh day, zwieback on the eighth, raw ham and butter on the tenth day after the hemorrhage. In this way it is possible to cover half the calorie requirement at the end of the first week; and entirely at the end of the second. This is more easily possible as the patient must observe absolute rest in bed.

Wirsing recommends the method of Lenhartz in fresh hemorrhages, that of Leube-Ziemssen in ulcers which do not bleed. An improvement of the anemia certainly acts favorably on the healing of the ulcer. Lenhartz, therefore, even a week after the hemorrhage, gives Blaud's pills, very finely ground.

Fleiner recommended the treatment with bismuth to cover the ulcerative surface. Rosenheim advocates this treatment, whereas Boas, Ewald, and v. Leube are skeptical, since the bismuth promises

success only when combined with v. Leube's rest cure and a corresponding diet. Occult hemorrhages are constantly observed during the bismuth treatment. Between the attacks of hemorrhage 1.5 gm. bismuth may be given three times a day, one hour before eating. Daily doses of 10 to 20 gm. bismuth as well as the use of the stomach-tube can certainly be dispensed with, especially if after taking the bismuth the patient assumes such a position that, according to the probable location of the ulcer, a coating may be formed over it. Instead of bismuth, bismutose may be given in knife-point doses three times a day or, instead of bismuth, a mixture of talc and chalk.

If a severe hemorrhage of the stomach has occurred, absolute rest in bed and abstinence from food are indicated, with nausea a narcotic, an ice-bag on the epigastrium, and the administration of styptics. In recent times, adrenalin and gelatin have obtained a certain fame. Up to 200 gm. of a 5 per cent. gelatin solution may be used in a day internally, or it may also be used subcutaneously. Fenwick boils 1.3 gm. dried suprarenal substance with 230 gm. water, giving this for one dose, which may be repeated once after two hours. The procedure of the autotransfusion above described seems to be dangerous and should be avoided (Senator). Infusions of physiological salt solution, up to 1 liter, given after the hemorrhage has ceased, are sometimes the means of saving life in severe cases of hemorrhage.

In recent times G. Klemperer advocated a new remedy with which to check gastrointestinal hemorrhages and cauterize gastric ulcers. This is eskalin, a preparation consisting of two parts of finely powdered aluminum and 1 part glycerin. It is placed on the market in the form of tablets of 2 1/2 gm. and is used in the following way: four tablets are dissolved in half a glass of water and taken on the empty stomach. If a portion remains undissolved, more water is added and again drunk. The patient should not eat for the following two hours. In profuse gastric hemorrhage, this remedy, together with Leube's diet, has given good results. If the hemorrhage is very violent and recurs constantly in spite of all treatment or if the danger of perforation is imminent, surgical intervention will be indicated. Excision of the ulcer or gastro-enterostomy will be performed to prevent the continual irritation of the ulcer by the passage of food.

If the hemorrhage has been definitely checked, the mode of life and diet of the patient still demand careful supervision. By way of aftertreatment, alkaline water, as Karlsbad Mühlbrun, 100 to 300 gm. daily, will be found of good service.

(*d*) Ulcer of the Duodenum and Esophagus.—The duodenal ulcer, too, is produced by the action of pepsin, and not, as might be supposed, by that of trypsin. It is observed following thrombosis, embolism, or atheroma of the blood-vessels, in hyperchlorhydria,

in the second week after cutaneous burns, and in uremia. In other cases Nothnagel observed hematemesis and bloody stools which contained partially digested food, mixed with bile and pancreatic juice. Duodenal ulcer is characterized by the late appearance of pain, three to four hours after ingestion. In ulcer of the cardia or esophagus the pain follows immediately the ingestion of food, and indeed may be felt on each act of swallowing.

The treatment corresponds, in general, with that of the bleeding gastric ulcer. Only opium will have to be added to quiet the movements of the intestines. The blood retched out in esophageal ulcer contains, as a rule, no food particles, and is not dark red like that from the stomach, owing to the action of the acid.

(*e*) Other Kinds of Gastric Hemorrhage.—*Cancer of the Stomach.*—All other kinds of gastric hemorrhage are inferior in frequency to that of gastric ulcer, except, perhaps, that of cancer of the stomach. But gastric hemorrhages due to carcinoma are almost constantly of lesser degree, so that the coffee-ground vomitus, though diagnostically of great importance, is of less interest therapeutically.

In Stasis.—Severe, indeed, fatal hemorrhages may occur in venous hyperemia of the stomach, which itself shows no tissue changes; thus in cirrhosis of the liver or in pylethrombosis. At the same time small congestive hemorrhages may occur in the gastric mucosa, even septic erosions in pylephlebitis.

In Banti's Disease.—The association of a constitutional tendency to hemorrhage with congestive and thrombotic processes explains the often fatal hematemesis in Banti's disease.

In Hemorrhagic Diathesis.—This leads us to those gastric hemorrhages which are observed in purpura, leukemia—in short, in all the hemorrhagic diatheses in the larger sense of the word and in congenital hemophilia. In purpura gastric hemorrhage may be the first symptom at a time where other hemorrhages are still absent. "Hemophilia," too, may be entirely restricted to the stomach, as in the case of Huismans. Anatomically, no bleeding points can be found in the stomach, as in certain intoxications and in uremia and cholemia. From the capillary network, bleeding takes place into the glandular tubes, and from here the blood often comes in large quantities into the stomach, a phenomenon analogous to the blood-sweating of the hysterical (Benvenuti). However, these "Essential" hemorrhages may be simulated by minute ulcers (Riegel).

Postoperative Gastric Hemorrhage.—Of special interest are the gastric hemorrhages following surgical intervention in the abdomen, to which v. Eiselsberg first called attention at the Congress of German Surgeons in 1899. In this condition we probably have to deal with the direct or retrograde displacement of thrombi after ligation of

portions of the omentum or mesentery. Also stretching of the gastric wall may lead to lesions of the submucous tissue, to the detachment of the mucosa, followed by necrosis, and thus to hemorrhage, the occurrence of which may be not earlier than a week after the operation.

Septic Processes.—From the resorption of toxins, necrosis of the mucosa, the formation of erosions, and hemorrhages may develop in septic processes. The bleeding may further occur in the form of innumerable small foci by diapedesis. Both forms are found in perityphlitis, with severe septic manifestations.

Gastric Crises.—Of much interest is the gastric hemorrhage which has sometimes been observed in gastric crises; it is probably due to vasomotor influences, since the subacid chronic gastritis usually present has no tendency to produce hemorrhage.

Intestinal Hemorrhage.—Intestinal hemorrhage, too, shows blood in the stools; its source may be localized with some probability from the appearance of the stools, though the influence of an active or sluggish peristalsis must not be overlooked. The etiology is in many regards similar to that of gastric hemorrhage; *i.e.*, hemophilia, hemorrhagic diathesis, and primary blood diseases, emboli in the intestinal vessels, portal and general congestion, septic and other severe infectious processes (malaria), certain intoxications with cauterizing substances, as acids, lye, and corrosive sublimate; further, intoxication with phosphorus and autointoxications (cholemia and uremia). To these must be added the ulcerative processes in the intestine, as dysentery, typhoid fever, tuberculosis, enteritis, severe affections of the mucosa, as amyloidosis, injuries from gall and intestinal stones, anchylostomiasis, hemorrhoids, benign and malignant neoplasms, intussusception, volvulus, and, finally, incarceration, following its reposition. Varicose veins of the small intestines, and minute arterial aneurysms of the intestinal walls may, too, in some cases lead to hemorrhages.

Naunyn observed aneurysms of the hepatic arteries with effusion of blood through the bile ducts into the intestines; the arterial rupture may be produced by gall-stones. These affections are taken up here only so far as the intestinal hemorrhage stands in the foreground of all symptoms. This is not the case, for instance, in intussusception, since the passage of blood-tinged mucus or of slight quantities of pure bloods stands in no relation to the severe symptoms of absolute obstruction of the intestines. For the same reason, embolism of the mesenteric artery will be taken up in the discussion of that striking symptom, violent abdominal pain, leading to collapse, with which this condition sets in.

Typhoid Fever.—Probably the most violent intestinal hemor-

rhages are observed in typhoid fever, usually toward the end of the second week, due to the opening of a vessel in the shedding of necrotic scabs. The hemorrhages occurring on the tenth to the twelfth day are considered to be the most dangerous (Duplant). Bleeding at an earlier date originates from the loosened congested plaques. In children where the typhoid changes in the intestines are usually less pronounced than in adults, intestinal hemorrhage is much less frequent, except when a severe hemorrhagic diathesis exists at the same time—typhus petechialis (Curtin). Men are in greater danger than women in the occurrence of severe loss of blood, as is the case also in gastric hemorrhage.

The appearance of intestinal hemorrhage is characterized by a marked fall in temperature and a lowered tension of the pulse, together with increased frequency; bloody stools may fail to appear for hours or days, due to the sluggish peristalsis of the prostrated patient. The favorable influence which slight intestinal hemorrhages sometimes have on temperature, sensorium, and headache does not prevent us from considering intestinal hemorrhage a very serious occurrence, which should be avoided if possible and energetically combated if present. Any error in diet at the critical time must be strictly avoided, liquid food only being allowed. This, combined with absolute rest in bed and the avoidance of all rubbing of the abdomen during the bath, is the chief prophylactic measure against intestinal hemorrhage, but which, of course, will prevent only a small number of them. If hemorrhage has once occurred, absolute rest on the back and complete abstinence from food is indicated. The patient must be quieted and his intestines inactivated by opium suppositories and injections of morphin. Duplant recommends warm enemas at 48° to 50° C. Excitants are to be given only on threatening cardiac weakness; autotransfusion and the infusion of physiological salt solution may be tried; otherwise, on slight collapse one would better not intervene, in order that a thrombus may form rapidly in the bleeding vessel.

Medicinal styptics are generally not used before the fourth or fifth week. It is not yet decided whether ice-bags and ice-water enemas do not do more harm by stimulating peristalsis than good through the reflex contraction of the vessels. Adrenalin, gelatin, and normal serum may be tried.

Dysentery.—We distinguish the sporadic and epidemic dysentery from the amebic dysentery, common in the tropical and subtropical regions. Since the Spanish-American War in 1897 amebic dysentery has been repeatedly found even in the northern States. Bacillary dysentery, in regard to the etiology as well as to the clinical picture, is by no means a uniform disease.

Two different types of bacilli have been found, one by Shiga-Kruse, the other by Flexner. Dysentery infections are not uncommon in childhood; indeed, the first feeding with cows' milk has sometimes led to a dysentery infection. The disease of the Flexner type is usually the more infectious, but it runs a milder course, which may be over in a few days. The stools may consist entirely of pus and blood. Sometimes, however, pus corpuscles and erythrocytes can be detected only with the microscope, and then only for a day or two.

Much more serious is the prognosis in amebic dysentery. Bloody, mucoid stools, smelling like glue, are generally prognostically favorable, whereas a carcass-like smell, necrotic shreds of intestinal tissue, and fibrinous masses indicate a severe course.

A stronger hemorrhage is observed in bilharzia flux, a dysenteric condition due to distomum hæmatobium; this hemorrhage is prone to be especially profuse when there is an associated formation of multiple intestinal polyps (polyposis).

The treatment must aim to check the intestinal hemorrhage, especially in the bilharzia dysentery, which may lead to a severe grade of anemia. Abstinence from food and the whole armament of internal styptics will have to be considered. The ulcerative process demands intestinal disinfection with castor oil, calomel, salol, naphthalin, naphthol.

The serum treatment of dysentery, as inaugurated by Rosenthal, Dopter and Vaillard, Kraus and Dörr, has shown very favorable results. Of course an exact bacteriological diagnosis must be made before it is used.

In amebic dysentery, radix-ipecacuanhæ, in powders of 1 gm., is much in favor, best combined with opium to avoid vomiting. Intestinal lavage with large quantities of liquid must be performed. A 1/4 to 1/2 per cent. solution of tannic acid, a 2 per cent. boric acid solution, a bismuth emulsion (5 to 10 gm. : 300 water) and a solution of quinin hydrochlorid (1 : 1000) may be used. Silver nitrate in a 1 : 1000 solution may produce severe tenesmus, whereas a thin starch paste with the addition of 10 drops of the tincture of opium has a soothing effect. During the most severe stage the diet has to consist of thick soups and milk, if the latter is well tolerated.

Dysentery is much more frequently found in children than was originally supposed. Many an acute follicular enteritis has proved to be a dysentery affection since the bacteriological examination has been made in these cases.

Colitis of Infants.—Slight admixture of blood in muco-purulent stools is found in the colitis of infants produced by alimentary disturbances or by contact infection in hospitals (streptococcus enteritis and coli colitis—Escherich).

In treating these cases milk is abandoned, tea and children's foods are given. A laxative should be given until the tenesmus has ceased. Disinfecting intestinal lavage and the administration of astringents per os in the following days will complete our treatment in an effectual way. In acute intestinal catarrh without the formation of ulcers the inflammatory hyperemia rarely leads to the presence of blood; if present, this is very slight; it is more frequent in catarrh of the large intestine, the mucus passed being of a reddish tinge or containing traces of blood.

Catarrhal and Decubital Ulcer.—In acute catarrh of the large intestine, more rarely of the small, and on exacerbation of chronic catarrhs ulcers may be formed. Sometimes the folliculi are their seat, and we then speak of follicular ulcerations. The pressure from stagnating fecal masses leads to intestinal ulcer sometimes. In this way there develop the annular, decubital ulcerations, which are chiefly localized in the cecum, appendix, at the flexures, in the sigmoid and rectum. Abundant hemorrhage, as in typhoid and dysentery, is uncommon here.

Anthrax Ulcer; Intestinal Ulcer in Other Acute Infections.—Intestinal anthrax may lead to hemorrhagic infiltrations which soften with ulcer formation. In septicemia intestinal ulcers have been observed in very rare cases, more frequently in erysipelas and small-pox.

Tubercular Ulcer of the Intestine; Syphilitic Ulcer of the Intestine.—Intestinal ulcers are very frequently of tubercular nature. But very extensive ulcerative processes may be found post-mortem, which *intra vitam* have caused no manifest hemorrhages. Acute hemorrhages have in some cases been observed, but the chief danger of tubercular ulceration, as of syphilitic ulcerations, which are chiefly localized in the rectum, certainly does not lie in the enterorrhagia, but in the formation of stricture. Rare pathogenetic factors in the formation of ulcers are the breaking down of leukemic infiltrations in the ileum and the cauterizing action of ammonium carbonate, with the decomposition of urea, in uremia.

Carcinoma of the Intestine.—A mixture of blood and purulent mucus similar to that in dysentery may be met with in still two other conditions, in a low-sitting intestinal carcinoma and on perforation of a purulent focus into the intestines. Whereas in carcinoma of the sigmoid and rectum blood can usually be found macroscopically or at least microscopically in the feces, tumors sitting high up in the colon are characterized by occult hemorrhages in six out of twenty-seven cases. (Boas.) (Volkmann's collection, No. 387.)

In rectal carcinoma hemorrhoidal nodes may develop which may cause hemorrhage (v. Leube). Therefore, any hemorrhoidal bleeding

in elder individuals demands careful digital and rectoscopical examination. However, any tumor leading to a high degree of stenosis may, from coprostasis above the stricture, lead to croupous enteritis, and in this way to enterorrhagia.

Benign Tumors.—Benign tumors also may bleed, sometimes severely, if they are rich in vessels. These are adenomas, fibromas, myomas, and, chiefly, angiomas, and, in children, especially rectal polypi. Intestinal hemorrhage as well as imprints on the fecal columns lead to the suspicion of the diagnosis, which must be controlled by digital examination. The stem of a polyp may rupture, and in this way recovery occur spontaneously. This eventuality is best not awaited if the polyp bleeds severely, but it should be ligated. In multiple polyps of the rectum, amputation of the rectum may be indicated in rare cases.

Pulmonary Hemorrhage.—Pulmonary hemorrhage and the coughing up of blood are not entirely synonymous. Pulmonary hemorrhage may be present without coughing of blood, and, on the other hand, other sources than the lungs may have to be considered in hemoptysis. Pulmonary hemorrhage can be diagnosed only when all other sources of bleeding, by inspection of nose and pharynx, by laryngoscopy and by examination of the thoracic organs, are excluded. Behind the uvula distended superficial vessels may sometimes be found, though the other portions of the pharynx may not be swollen at all; if these bleed occasionally, they may in this way stimulate hemoptysis. Of course, a pulmonary hemorrhage may exist, when it is impossible physically to diagnose a pulmonary affection.

Simulation of pulmonary hemorrhage is not infrequent, especially in hysterical individuals, and even Galen gave the advice to examine the oral cavity and nose if there is a suspicion of simulated hemoptysis. In hemorrhages in the upper part of the esophagus produced by coughing spells, the differentiation may become impossible. Pulmonary hemorrhage begins with a sensation of heat and oppression, and a burning pain in the chest, and soon after the blood is expelled with coughing. The most frequent cause of hemoptysis is pulmonary tuberculosis. Even in those cases where another source, as, for instance, vicarious menstruation, seems very plausible, a beginning tuberculosis is usually latent, producing a *locus minoris resistentiæ*.

Pulmonary Tuberculosis.—Hemoptysis n pulmonary tuberculosis is a frequent, but by no means a constant symptom; especially in children of the first years of life it is very rare. Hemoptysis in the course of the disease occurs under two conditions: as an initial symptom and in the advanced stage of the disease. The old opinion of Niemeyer that hemoptysis produces the disposition to tuberculosis has long been refuted and abandoned. The initial hemoptysis may

occur in apparently full health and with negative findings in the lungs, as is readily understood since a tubercle, developing in the vascular wall, does not cause an extensive infiltration of the neighboring tissue. This initial form is usually rather slight and is important as a signal of alarm calling the attention of the patient to his condition and bringing him to the physician in time. Many authors, as Mircoli, explain it as a state of hemophilia, appearing at the onset of the disease when the time of coagulation of the blood is said to be considerably prolonged, and disappearing later. In the further course of the disease hemoptysis is usually absent, infiltration and obliteration of the vessels having been produced. Only later, when the formation of caverns has commenced, the vessels of the caverns are dilated by miliary aneurysms and hemoptysis again becomes frequent. At certain times hemoptysis occurs repeatedly. Changes in the humidity of the air, low barometric pressure, cold, etc., are blamed as exciting factors.

The danger of hemoptysis lies in the loss of blood and in the danger of suffocation, especially in violent hemorrhages, and, on the other hand, in the spreading of the infection through aspiration of the blood containing tubercle bacilli. However, the exacerbation often observed after hemoptysis has often been the *cause* of the hemorrhage, merely indicating the hastening decomposition of the lung tissue. Nor must any dulness newly observed after the hemorrhage be considered as a spreading of the tubercular process in this region, for we have here to deal with the aspiration of blood, a fact made plain by the resorption and clearing up of the dulness in a few days. Some forms of hemoptysis are to be observed during the process of healing, the cicatricial contraction leading to local congestion. Indeed, these hemorrhages may sometimes be very extensive.

The danger of a pulmonary hemorrhage is not to be overestimated. If the physician sees a patient with hemoptysis he may usually quiet the concerned family, for fatal hemoptysis leads to death within a few minutes. Of special importance for the prognosis of the further course of the disease is the body temperature in the next few days.

The treatment must first aim to arrest the hemorrhage. The patient should observe absolute rest in bed and also mentally be quieted. To avoid the coughing spells we may give a morphin injection. All attempts to immobilize the lung, which is the seat of the hemorrhage, by compression or strips of adhesive plaster have been without results. This aim may be reached to some extent by the use of an ice-bag, whose action by cold is somewhat problematic. The patient receives only cold liquids and a slight laxative. An excellent method of arresting the hemorrhage is the so-called "tying off of the limbs by ligature," used since the earliest times. It is per-

formed in such a way that each limb is tied around with an Esmarch bandage or towel, as near as possible to the trunk, so tight that the veins are all compressed, but the pulsation of the artery remains palpable. In this way a great quantity of the blood rests in the extremities and is not emptied into the right heart, less blood therefore reaches the lungs through the pulmonary artery, a condition favorable for thrombus formation. After the bandages have been left on for half an hour they are removed, but not all four at the same time, for in this way the right heart and the lungs would suddenly receive the whole quantity of blood which has accumulated in the extremities, and the hemorrhage would start afresh. Styptics used internally are of little value. Ergotin, fluidextract of hydrastis, and stypticin, an oxidation product of narcotin, may be tried. Some authors ascribe special effectiveness to the acetate of lead. It is very important to decrease the irritation to cough, and this may be attempted by administering the usual narcotics, morphin, codein, and heroin also oil of turpentine, 5 to 8 drops five times a day. After the hemorrhage has been checked, the patient has to be kept in bed for several days. When the hemorrhage has been brought to a standstill, the removal of the effused and aspirated blood deserves our attention. The patient, afraid to cough, must be encouraged to do so by the physician or nurse, and expectorants may often be avoided by this means. The so-called vicarious hemoptysis is in most cases the sequela of a pulmonary tuberculosis, and the absence of menstruation is only an occasional factor in the occurrence of the hemorrhage (Andral, Sticker); however, other authors, as Cornet, Sée, v. Korányi, are inclined to believe that vicarious hemoptysis may occur even in entirely healthy lungs. To consider the suppression of an expected hemorrhoidal hemorrhage as the only cause of hemoptysis will be even less justifiable.

Hemoptysis of Pregnancy.—Hemoptysis occurring during pregnancy is not to be explained by plethora gravidarum, for exact examination shows almost constantly the presence of a tubercular focus in the lungs or a mitral lesion.

Hyperemia of the Lungs.—In all congestions of the lesser circulation, due to cardiac failure, hindered expansibility of the lungs in pleural adhesions, mediastinal tumors, or kyphoscoliosis, pulmonary hyperemia is produced with the same regularity as the venous stasis in the periphery. In the sputum, hematoidin and also unchanged blood are found. A true hemoptysis is rare, but occurs in cases of arteriosclerosis of the pulmonary artery, whose development is favored by the increased pressure in the lesser circulation. By this condition may be explained perhaps the rare and scarcely ever extensive hemoptyses of emphysematous patients. Still in some cases

they may be due to stasis or gouty changes (Huchard). The old conception that congested lungs are rarely affected with tuberculosis or are even immune against the infection has been long refuted.

Hemorrhagic Infarct.—If a true hemoptysis occurs in a cardiopathic, the possibility of a hemorrhagic infarct by an embolus in one of the branches of the pulmonary artery must be considered. Typical wedge-shaped infarcts may sometimes be found without occlusion of the afferent vessels. Of all cardiac affections, mitral stenosis is the lesion in which infarcts occur most frequently. Trousseau has pointed out that pulmonary hemorrhages in advanced age are due much more rarely to tuberculosis than to heart failure and vascular changes. The hemoptysis in hemorrhagic infarct is seldom violent, but persists usually for days or weeks. Blood and sputum are usually not so intimately mixed as in pneumonia, but just the tenacious quality of the sputum may, on the other hand, cause it to be mistaken for that of croupous pneumonia. The differential diagnosis can be made by the afebrile course and the cardiac findings. In all these cases we must strive to relieve the pulmonary circulation and to improve the cardiac force, which may be accomplished by absolute rest in bed and cardiac tonics. In mitral stenosis, digitalis is usually followed by the best results. In many cases, however, we cannot save life. The prognosis does not depend, usually, on the quantity of blood expectorated, but on the extent of the vascular region obstructed by the embolus, and indeed the most serious embolus may lead a course without any considerable hemorrhage.

Croupous Pneumonia.—The sputum in croupous pneumonia may be of true hemoptysic character, but in the greatest number of cases it is rust-colored (sputum croceum) or slightly sanguinolent. In the stage of engorgement hemoptysis will be found chiefly in phthisical patients, in alcoholics, and in those with congested lungs. Indeed, this stage of pneumonia, like vicarious menstruation, may lead to the discovery of a latent tubercular focus.

Hemorrhagic Bronchitis.—Bronchitis may produce a hemorrhagic sputum; this is especially true of influenza bronchitis, where it is found for days and weeks without coexisting phthisis. In fibrinous bronchitis, hemoptysis occurs entirely independent of the frequently coexisting tuberculosis. It is perhaps due to lesions produced by the removal of the fibrinous coagula from the epithelial surfaces.

Other Lung Affections.—Bronchiectatic cavities, which often can only be distinguished postmortem from tubercular cavities, may be associated with very violent pulmonary hemorrhages. These may also be found in the suppuration and the putrefaction of pneumonic foci, in pulmonary abscess, and in gangrene, in the latter also in children.

Another rare form of hemoptysis, to be observed in childhood, is due to the perforation of suppurating or caseous bronchial glands into the pulmonary artery and the bronchial tree. In advanced age, anthracotic softened glands may produce the same manifestations. These forms of pulmonary hemorrhage usually lead immediately to death from loss of blood or suffocation. The same is true in the perforation of an aortic aneurysm into the pulmonary artery. In latent tubercular foci and those in the process of cicatrization, hemoptysis may be produced by absorbent remedies, as mercury and iodin. In the same way the use of thiosinamin may lead to hemorrhage in tubercular individuals. This drug, which exerts a softening action on cicatricial tissue has therefore to be abandoned in persons suspected of tuberculosis. Koch's tuberculin, by its specific action, produces necrosis of the tubercular tissue and brings about a state of hyperemia and strong inflammatory reaction in the neighboring tissue. It is therefore not to be wondered at if hemoptysis has been observed during a tuberculin treatment. Lepra, syphilis in the tertiary stage, and malaria, in rare cases, lead to destructive processes in the lungs, which may be associated with bleeding; the same may be the case in actinomycosis, in aspergillosis, and in infection with distomum pulmonale, which is common in Japan. All lesions of the lung produced by puncture, gunshots, fracture of the ribs, or aspiration of foreign bodies are associated with pulmonary hemorrhages. At the same time hemothorax may develop, the blood effusing into the pleural cavity, and sometimes hemopneumothorax.

Hemothorax.—Hemomediastinum.—The opening of pulmonary vessels or of the internal mammary artery with injury to the pleura may lead to extravasation of blood into the pleural cavity or into the mediastinal cellular tissue. Death may occur by the severe hindrance to respiration or by the loss of blood. In three-quarters of all pulmonary injuries a more or less developed hemothorax is to be found.

Especially dangerous are the pathological hemorrhages which occur from the intercostal arteries in caries of the ribs, from the internal mammary artery in mastitis and in aneurysm and pulmonary gangrene. Only the severe collapse or well-developed manifestations of pulmonary compression will excite the suspicion of an internal hemorrhage, and the treatment, which must consist in surgical intervention, in this way comes too late. The dulness in hemothorax behaves in the same way as in hydrothorax. Since the blood remains liquid for a long time in the serous cavity, prompt change of sound occurs on change of position, unless encapsulation has been produced through secondary inflammation (Sahli).

The exploratory puncture constantly gives pure blood. In other conditions the fluid may be blood-tinged only from the injury of a

vessel. A slightly bloody discoloration of the exudate or a blackish color due to transformed hemoglobin may be found in hemorrhagic exudate, in a hemorrhagic diathesis, as, for instance, scurvy. Further, in tuberculosis and carcinoma of the pleura (v. Leube) and in severe alcoholics (v. Schrötter).

Cardiac and Thoracic Vessels.—Erosions of the vessel walls in the thorax occur very frequently in aneurysm.

Hemopericardium.—Erosion of the innominate artery with normal walls may be produced by a tracheal cannula leading to decubitus of the anterior wall of the trachea. Frequent change of the tubes, using those of different lengths and curvatures, is the only means of preventing this fatal accident. Disregarding rupture of the heart or of the great vessels by trauma or pathological processes, we have to discuss the dangers arising from intrapericardial hemorrhage. One hundred and thirty to 200 c.c. of blood effused into the pericardium are sufficient to produce death by tamponade of the heart, hindering diastole. In this way lesion of the coronary artery leads in a short time to exitus; other arteries which may directly pour their blood into the pericardium are the internal mammary and the intercostal arteries. In these cases the pressure of the extravasation exerted on the heart must be relieved by puncture or incision into the pericardium (Tillmanns). The exudate in pericarditis may become hemorrhagic under the same conditions as that in pleurisy; it cannot be confused with hemopericardium if an exploratory puncture is performed and the history is taken.

Hemorrhage into the Free Abdominal Cavity.—Hemorrhage into the free abdominal cavity develops most frequently from injuries, from the rupture of a tube in extrauterine pregnancy, lesions of the liver, spleen, from aneurysm, and from erosions of a vessel by an active purulent focus, as a perityphlitic abscess. The most common cause is a tubal abortion. The blood first collects in the lower pelvis and then gradually ascends; sometimes it may be encapsulated (pelvic hematocele). Hemorrhage into the free abdominal cavity is announced by rapid development of a pronounced anemia. The features become sunken, the pulse at first may still be vigorous and strong, but shows great variation in tension and frequency and the temperature sinks. The peritoneum reacts to the irritation of the effused blood by reflex nausea and severe pain. On long duration dulness may be found in the lateral portions of the abdomen. Palpation is usually negative, but the rectum may protrude owing to the filling of the pouch of Douglas by coagula of blood. Hemorrhagic peritoneal effusions are found in all those forms of peritonitis which are associated with a pronounced local venous stasis, as volvulus and internal incarceration, in the hemorrhagic diathesis, in carcinoma

and tuberculosis. Repeated puncture of an ascites may lead to severe congestive hyperemia, and to changes consisting in the formation of pseudomembranes with hematomata between them, which Friedreich considers analogous to those of the chronic hemorrhagic pachymeningitis. The transudation in these cases may be completely hemorrhagic.

Hemorrhages in the Abdominal Wall.—A peritonitis may be simulated by a hematoma of the abdominal walls, as has been described by Perochand and Doucet. With severe pain, a tumor develops in the region of the recti, and at the same time ecchymoses may appear above the symphysis and on the upper parts of the thigh. These hematoma may undergo suppurative changes.

Hematuria.—Differential Diagnosis from Hemoglobinuria.—Hematuria must be sharply distinguished from hemoglobinuria. The latter is characterized by the appearance of dissolved hemoglobin in the urine, and the urine, therefore, may be completely clear while intensely tinged with blood. On the other hand, the admixture of even slight quantities of blood always causes a marked turbidity of the urine. In this way, on the first glance, one is able to distinguish with some probability the two conditions. The microscopical examination of the sediment gives the certain diagnosis, which in hemoglobinuria never shows red blood-corpuscles, but some fragments of hemoglobin, which sometimes form casts.

Source of Bleeding.—If the diagnosis of hematuria has been determined, the next question is, does the blood originate from the kidneys or the deferent urinary passages? In renal hemorrhages due to hemorrhagic nephritis the amount of albumin found is usually larger than would correspond with the content of blood, and this is due to the albuminuria. Gumprecht has called attention to the fact that fragmented red blood-corpuscles constantly originate in the renal parenchyma; only here is, according to his opinion, the concentration of the urea sufficient to produce this fragmentation.

Hemorrhagic Nephritis.—The renal origin of the hemorrhage can be assumed with certainty if undoubted blood-casts are found or any other cast carrying blood-cells. The presence of a considerable amount of blood in the portion of the urine last produced points to a low seat of the hemorrhage, to cystic origin. Certain molds, as of the renal pelvis, may have a sufficiently characteristic form to permit the conclusion that the blood was present for some time in a certain portion of the urinary passages. In some cases, however, cystoscopic examination or renal catheterization will be the only methods of deciding the origin of a hemorrhage. The most frequent cause of hematuria is parenchymatous nephritis in its acute or chronic form. It is most frequently found in the nephritis of scarlet fever. Any

hemorrhagic nephritis of childhood demands careful examination in regard to a previous scarlet fever, perhaps overlooked. Only the lightest forms of scarlatinal nephritis show no blood in the urine; it occurs usually together with the albuminuria or a few days later. Neither hematuria nor albuminuria is a source of immediate danger to life in acute nephritis. The prognosis is much more dependent on the quantity of urine. In the chronic form the amount of blood is usually less and changes frequently. In contracted kidney, erythrocytes in the sediment are not a regular finding. Sometimes, however, after physical exertion there may be observed an exacerbation of the nephritis with a rapidly disappearing hematuria. Amyloid kidney does not lead to hematuria.

The prognosis of the acute hemorrhagic scarlatinal nephritis is, according to Heubner, a favorable one; six-sevenths of all cases recover. Of even better prognosis is the nephritis following diphtheria, which is rarely of strongly hemorrhagic character. In all acute infectious diseases, especially of childhood, nephritis with hematuria may occur; in adults, especially in genuine pneumonia. The chronic hemorrhagic nephritis has not the same grave prognosis in children as in adults, relatively many recoveries occurring.

The treatment has scarcely to undertake any measures against the hematuria itself. The formerly much used astringents, given internally, as tannin preparations, alum, and ergot, are entirely useless. Gelatin is absolutely contraindicated. There is only one remedy which acts against the threatening uremia and is at the same time very suitable in combating the hyperemia of the kidneys. This is the removal of blood in the renal region by the application of leeches.

Toxic Nephritis.—Toxic nephritis resembles the just-mentioned acute hemorrhagic form in regard to the urinary findings, but differs by the absence of any dropsy. Hematuria is very frequent after intoxications; cauterizing acids and alkalies, phosphorus, sublimate, carbolic acid, and balsams, especially santalic oil, etc., may lead to it.

Unilateral Renal Hemorrhage in Nephritis.—The modern methods of catheterization of the ureters have taught us that even in diffuse nephritis a unilateral hematuria may occur. Angioneurosis of the kidneys, too, is said to lead to hemorrhage (néphralgie hématurique), but in these cases we probably always have to deal with a hemorrhagic nephritis.

Traumatic Renal Hemorrhage.—Violent trauma of the kidneys leads to renal hemorrhage; also those lesions which are produced by urinary calculi in the papillæ of the kidneys or in the mucosa of the renal pelvis. If during an attack of nephrolithiasis the ureter on the affected side has become completely obstructed, the urine will be

clear, otherwise it contains pus and blood, sometimes cylinder-like blood coagula corresponding to the shape of the ureter.

Hemorrhagic Infarct.—Suddenly appearing violent pains in the kidney region, together with hematuria, occurring in a patient with a disease tending to infarct formation (endocarditis), will be suspicious for a hemorrhagic renal infarct.

Thrombosis of Renal Veins.—In the new-born and in infants who have been reduced by intestinal catarrh, thrombosis of the renal veins may develop, usually only toward the end, and constantly only in severely cachectic individuals; this renal thrombosis occurs chiefly in the left renal vein due to its longer course to the inferior vena cava which lies on the right side of the aorta.

Kidney Abscess; Kidney Tuberculosis; Kidney Tumor.—Renal abscess, renal tuberculosis and tumors of the kidney may occasionally be associated with hematuria. In carcinoma of the kidney, especially, hematuria is an early symptom, whose first appearance may be due to slight trauma. This symptom is present in one-half of all cases, and in a fourth of all cases it is the first symptom to appear. From its intensity, the bleeding may involve immediate danger. Obstruction of the ureter by blood coagula may produce ureteral colic. If the tumor infiltrates the ureter, hemorrhage is of course absent.

Early diagnosis alone may render possible a life-saving extirpation of the kidney, provided that the function of the other kidney is sufficient. Adrenalin and gelatin will have to be tried to arrest the hemorrhage: an ice-bag on the lumbar region, lead acetate, or an injection of ergot have been advised.

Kidney Tumor in Childhood.—Carcinoma of the kidney is not rare in childhood; about one-third of all cases occurs in children from the first to the eleventh year. Still more frequent in childhood is sarcoma which often takes a very rapid course. Of 30 cases of sarcoma more than half occurred in the first decade of life. Hypernephromas, very vascular and malignant neoplasms, show a great tendency to hemorrhages; the whole tumor may be destroyed by a blood extravasation and transformed into a large sac filled with blood.

Constitutional Diseases.—Renal hemorrhages are further found in all hemorrhagic diatheses, in hemophilia and in leukemia. If in the first-mentioned condition no other than renal hemorrhages are present (the renal hemophilia of Senator), extirpation or decapsulation of the affected kidney may be performed with success (J. Israel).

Parasites.—Parasites of the different urinary passages occasionally incite renal hemorrhages in tropical regions, thus, for instance, distoma hematobium and filaria sanguinis.

Pyelitis.—Pyelitis, of whatever etiology, may lead to the presence of blood in the urine, this occurs most frequently in pyelitis calculosa.

The presence of blood coagula in the form of molds of the ureters, as well as a colicky attack produced by the obstruction of the ureters, will enable us sometimes to decide a difficult diagnosis between cystitis and pyelitis.

Hemorrhage from the Bladder.—*Calculi.*—Hemorrhage from the bladder may be due to trauma from concrements, especially from oxalate stones with their irregular surfaces. It is often the first and only sympton of the disease, only rarely becoming severe, and this chiefly in long-continued violent concussion of the body, as in horse-back riding.

Ulcer.—The stones sometimes produce ulcers from decubitus, which, like the chronic ulcers, usually of tubercular nature, have a tendency to bleed; typhoid and diphtheric ulcers of the bladder rarely lead to hemorrhages.

Venous Stasis.—A severe venous stasis in the bladder, as it occurs in cirrhosis of the liver, pregnancy, etc., may cause hemorrhage. This is, however, a rare occurrence, as are the hemorrhages from vesical varices, which, before the days of cystoscopy, were considered as the cause of many urinary hemorrhages. If, on severe retention of the urine, the bladder is emptied too rapidly, the sudden decrease of pressure may lead, indeed, to abundant bleeding.

Toxic Hemorrhage from the Bladder.—Intoxications, as with cantharides, cause not only intense irritation of the kidneys, but also severe cystitis, often associated with hemorrhage and tenesmus of the bladder.

Constitutional Diseases.—All general infectious diseases and constitutional anomalies which lead to renal hemorrhage may occasionally show a passage of blood from the cystic mucosa.

Tumors.—In tumors of the bladder hemorrhage is a very constant finding, due either to ulceration or to the papillary structure of the tumor, whose tissue, rich in vessels and readily vulnerable, is very apt to bleed. In the first place, we will have to mention the papillary carcinoma and the benign papilloma, which sometimes cover a great part of the mucosa (vesica villosa), developing on the floor of chronic inflammatory processes.

In case the hemorrhage is conditioned by a stone or a tumor, we shall have to remove the one and extirpate the other, and indeed even if the tumor is of a benign nature, as it may become dangerous from its tendency to bleed. In just these cases operative results are satisfactory and enduring. In children tumors of the bladder are rare, sarcoma being the most frequent; in spite of operation, it is of very unfavorable prognosis.

The treatment of hemorrhage of the bladder demands absolute rest, which is effectively aided by the application of an ice-bag in the

region of the symphysis, which requires the patient to keep his pelvis quiet. A cooling apparatus may be introduced into the rectum. Tenesmus of the bladder may be relieved by an opium suppository or a morphin injection. Irrigation of the bladder with silver nitrate 1 : 1000 may be considered; it effectively hinders at the same time the accumulation of blood coagula. Gelatin internally and subcutaneously, as well as adrenalin internally, subcutaneously, and in irrigations, have been used in recent times. One of the most efficacious remedies for checking the hemorrhage is absolute rest of the bladder, which may be brought about by drainage through a self-retaining catheter. In some cases, however, even this will be found insufficient; the bladder will have to be opened and tamponed to save life.

Hemorrhage from the Urethra.—Whereas in hemorrhage from the bladder it is the last portion of the urine passed which shows the greatest amount of blood, in hemorrhage of the urethra blood may appear independent of urination. The gonorrheal secretion shows only a few red blood-corpuscles, and only in severe cases a brownish black secretion, due to transformed hemoglobin.

Hemorrhage from the Genital Organs.—Hemorrhage from the genital organs is of greatest importance not only because it may lead to profound anemia and even death from obstinacy or abundance, but because under certain circumstances it is of the greatest semiotic significance. Thus metrorrhagia in the menopause is a symptom of a beginning carcinoma of the uterus. It is most emphatically urged here that the physician should not be satisfied with a hemostatic remedy or hot vaginal douches, in short with a symptomatic treatment, but should always find the cause of the hemorrhage, if necessary even by exploratory excochleation.

Hemorrhages of the Skin.—Hemorrhages of the skin differ clinically from simple congestion of the vessels by not disappearing on pressure, but rather becoming more manifest by contrast. Their color varies according to age and localization. The subcutaneous ecchymoses are of bluish color, the petechiæ and vibices (differentiated according to the circular or elongated form), situated in the pars reticularis, are bright red, and change their color to yellow and brown. Cutaneous hemorrhages are often combined with hemorrhages in the mucosa in general affections. They are often found associated with other hemorrhages, epistaxis, intestinal and renal hemorrhages, and those into the muscles and joints. The most harmless form of cutaneous bleeding is that due to flea bites. The fresh wheal with the central punctiform hemorrhage and bright red, erythematous area surrounding it assure the diagnosis. Severe infectious diseases are often associated with the formation of petechiæ, as septic and pyemic processes, ulcerative endocarditis, and Weil's disease; further, primary

diseases of the blood, as leukemia and hemophilia; phosphorus intoxication, the acute yellow atrophy of the liver; whooping-cough and epilepsy, during the attack, due to the severe venous stasis. Of less importance is the occurrence of hemorrhage in measles and scarlet fever. This is not due to a "dissolutio sanguinis," as was believed in earlier times, but to a severe persistent hyperemia of the skin. The cutaneous hemorrhages of severe septic measles, scarlatina, and diphtheria must not be confused with those just mentioned, not being strictly limited to single efflorescences. Purpura variolosa is the hemorrhagic form of small-pox which is very much dreaded, in which extensive cutaneous hemorrhages and exitus may occur before the characteristic exanthem has developed. If fully developed pustules become hemorrhagic ("black small-pox"), the prognosis is grave.

The Hemorrhagic Diathesis.—Cutaneous hemorrhage is the most conspicuous symptom of the hemorrhagic diathesis, the most important types of which will be discussed here. We distinguish the congenital hemophilia from the acquired conditions, purpura, scurvy, melena, and Möller-Barlow's disease.

Purpura Hemorrhagica.—The purpura diseases, according to Litten, are considered as an etiological entity. Only gradual differences exist between the different groups, which are distinguished according to the severity of their clinical course. Scurvy, as compared with purpura, is characterized by the multiple occurrence of hemorrhage and its relation to faulty nutrition.

Beside purpura simplex, we distinguish a purpura with internal hemorrhages—morbus maculosus Werlhoffii—and a purpura with rheumatic joint affections—peliosis rheumatica Schönleinii. Simple purpura is usually a harmless condition, characterized by the appearance of petechiæ in crops, with slight manifestations of a general infection. It heals usually in one to two weeks. In purpura fulminans extensive ecchymoses develop with enormous rapidity, in a few hours discoloring the whole of the extremities blue or black-red, leading to a dense infiltration of the cutis, while hemorrhages of the mucosa and of the internal organs, as otherwise found in hemorrhagic diatheses of severe course, are absent. Death occurs in twenty-four hours, at the latest on the fourth day. The morbus maculosus Werlhoffii is a condition not very frequently met with in middle age and very rare in children and old people; under this name we will comprise only those cases of purpura where internal hemorrhages are found as well as cutaneous, whereas Litten comprises under this term attacks of cutaneous hemorrhages also, especially in children, occurring without other form of hemorrhage. Hemorrhages from the nose and gums are found with especial frequency, though the latter never shows the character of that in scurvy. The disease may take a chronic pro-

tracted course, with a tendency to repeated relapse. The internal hemorrhages may then occur everywhere so that hemoptysis, hematemesis, melena, metrorrhagias, disturbed vision, severe nervous manifestations, and hemorrhages into the serous cavities develop. Severe anemic conditions result, which only after weeks and months lead to death. A chronic interstitial nephritis may sometimes follow the hemorrhagic changes. Purpura rheumatica, or Schönlein's disease, must not be attributed in its pathogenesis to polyarthritis rheumatica, with which condition it has only the symptom of articular pain in common. The differential diagnosis of peliosis rheumatica from acute articular rheumatism is not difficult: the joint symptoms are much more severe in the latter conditions, and cutaneous hemorrhages are observed only on the ground of a complicating endocarditis. To the picture of rheumatism, belong, further, profuse sweats, which are absent in rheumatic purpura. Septic processes may, too, of course, lead to metastases in the articulations and multiple hemorrhages. But the severity of the affection, its cause, and the etiology, usually demonstrable in sepsis, will assure the diagnosis.

Eruptions of erythema multiforme, of erythema nodosum, or of urticaria may be present at the same time (urticaria hemorrhagica, erythème polymorphe hémorrhagique).

The purpura abdominalis, described by Henoch, is characterized by vomiting, tenderness of the abdomen to pressure, colic, tenesmus, intestinal hemorrhages, and swelling of the joints. The disease occurs at intervals of weeks, even of months, and its fever curve resembles a very much protracted curve of intermittence. According to v. Dusch and Hoche, this condition is most frequently found between the ninth and twenty-fourth years of life, never in early childhood nor more advanced age. The treatment of purpura has, first, to emphasize absolute rest in bed, which often is not easily accomplished, as the general health is undisturbed. Relapses occur frequently if the patients get up too early, therefore patients must remain in bed at least a week after the last appearance of hemorrhage, and then get up very cautiously, in the beginning only for a few hours. Whether the skin still has a tendency to hemorrhages may be quickly decided by a method used by Hecht. A dry cupping glass with air-pump and manometer permits a very exact determination of the fragility of the cutaneous vessels. An easily digested, nourishing diet, with extensive use of milk, is important. The use of lemon juice has repeatedly given good results. Werlhoff, in his time, recommended the liquor acidus Halleri and the decoctum corticis chinæ for purpura.

Henoch used ergot with good results:

Rp. Extr. secal. cornut, 1.5 : 150.0
One dessertspoonful every three hours.

Litten prefers Fowler's solution and CO_2 baths. Gelatin will have to be used in severe hemorrhages. For intestinal hemorrhage and the pain of abdominal purpura atropin subcutaneously has proved of value. If the hemorrhagic diathesis is of malarial origin, the quinin treatment will often accomplish rapid recovery.

Scurvy.—Scurvy is a hemorrhagic diathesis usually occurring in epidemics and under unfavorable hygienic conditions. Swelling of the gums, with the tendency to bleeding, decay, and falling of the teeth, together with multiple hemorrhages of the skin, mucous membranes, and parenchymatous organs, are the chief symptoms. A peculiar cachexia follows, independent of the loss of blood. The hemorrhages, though not abundant, may lead to death by their localization, such as the intrapericardial, hindering cardiac diastole. It is important to know the fact that the changes of the gums may be absent at places free from teeth, as in children before dentition and in old people. The characteristic changes of the gums are most frequently found around carious teeth or old roots. A putrid fetor ex ore is constantly present. The cutaneous hemorrhages show a predilection for the extensor side of the calves, for the trunk, and for the arms, while the face is always free. The hemorrhages are especially extensive in the gluteal region. The subcutaneous and intramuscular hemorrhages, if rapidly developing, are associated with pain and an increase of fever. Hemorrhages of the mucous membranes may lead to death from loss of blood, as the often uncontrollable epistaxis. Hemoptysis occurs if pulmonary tuberculosis is present at the same time, intestinal hemorrhages, after the administration of laxatives.

Meningeal hemorrhages, very rarely apoplexy, abundant subconjuctival hematomata, effusions of blood into the anterior chamber of the eye, hemorrhagic choroiditis, retinal hemorrhages, as well as those into the sheath of the optic nerve, lead to various nervous disturbances and may injure the power of vision, temporarily or permanently.

Garrod found the best prophylaxis against scurvy in the use of mixed food rich in potassium salts of vegetable acids, and at the same time in the restriction of table salt, which formerly was excessively used on shipboard in the preparation of meat. In the English marine lemon juice is prescribed as an antiscorbutic; at the same time fresh vegetables are frequently supplied. It is entirely immaterial which vegetables are used, water-cress having no specific action as has been believed. The treatment consists in rest in bed, careful nursing, and the administration of the diet which has been found valuable in the prophylaxis of the disease. Protracted luke-warm baths are considered beneficial.

At the onset of the gum affections the removal of the tartar of

carious teeth and uncrowned roots may prevent a severe affection of the gingivæ. However, if it has once developed, the extraction of the teeth is contraindicated. The hemorrhages may be checked, when feasible, by tamponade. The usual styptics fail in most cases. Litten praises the use of ice. Our chief aim at first will be to avoid hemorrhages, and our precaution must go so far as to avoid the use of the stronger laxatives. The hyperemia of the intestine may lead to a fatal hemorrhage.

Moeller-Barlow's Disease.—Real scurvy is rare in children, but another condition has been designated infantile scurvy, as we believe, wrongly. This is Möller-Barlow's disease, which Möller first considered an acute exacerbation of rickets. This condition is endemic in North America, North Germany, Denmark, and Holland, and occurs usually between the sixth and twelfth months in artificially fed infants, especially if they have been fed with milk sterilized too long or conserved foods. Swelling of the distal epiphyses of the humerus appears with severe general disturbances; this may extend upward some way over the diaphysis and is caused by a blood effusion into the periosteum. Other bones are involved more rarely. A hemorrhage into the orbits may lead to a very disfiguring protrusion of the eyeballs. Hemorrhages into the skin and mucosæ, hematuria, hematemesis, and melena, very rarely meningeal apoplexy, may be present in severe cases. Changes in the gums may increase the resemblance to scurvy. Fractures of bones and separation of the epiphyses not at the line of junction, but in the shaft of the bone, and therefore, in fact, fractures, too, occur not infrequently. This fragility of the bones and their painfulness to touch and on movement explain the original opinion that the disease was an acute form of rickets.

The prognosis of Barlow's disease is favorable only if an appropriate treatment is commenced in time. Then complete recovery will result, though the convalescence is protracted. A slight degree of hematuria may remain even for months; this, however, does not usually lead to chronic nephritis, as is so frequently the case in purpura hemorrhagica.

The treatment consists, first, in changing the artificial way of feeding. Human milk, even in children over one year, cows' milk boiled for a moment, or, if from an unobjectionable source, in the raw condition, diluted according to the age of the child, will be the best food. If the child is almost one year, a trial may be given to the "antiscorbutic" diet consisting of apple sauce, spinach, purée of carrots, and lemonade.

Hemophilia.—Hemophilia is the congenital, constitutional tendency of traumatic hemorrhage to resist all styptic measures. In pronounced cases spontaneous bleeding may occur. The condition

resembles the acquired hemorrhagic diathesis, in the swellings of the joints, and the rheumatic pain. Of special interest is the fact that this condition is hereditary in a certain elective way. Grandidier deduced from the genealogy of 200 families of bleeders the conclusion that the males usually have healthy offspring if their wives are not hemophilic, even if they themselves show this constitutional anomaly; that, on the other hand, the females of these families have children who always have a pronounced hemophilia, even in cases where the females themselves are not hemophilic.

Hemophilia may manifest itself in the new-born by an uncontrollable epistaxis. Circumcision may be the cause of a fatal hemorrhage, whereas vaccination does not usually involve any danger. Physiological conditions, as dentition, menstruation, and parturition, may cause uncontrollable hemorrhages. The slightest stimuli may lead to severe bleeding, blowing of the nose to epistaxis. Hemorrhages in the gums, lungs, stomach, intestines, and kidneys, resulting from slight trauma, may resist all therapeutic measures for days or weeks. Hematomata of the skin, muscles, articulations, and conjunctivæ occur, whereas blood effusions into serous cavities are rare. Especially dreaded are hemorrhages localized on the head and those from scars and ulcerative surfaces. Those organs which are not exposed to trauma are, in general, free from hemorrhage. In this immunity of the parenchymatous organs, with the exception of the kidneys, Strumpell sees a difference between this condition and the acquired hemorrhagic diatheses.

The prognosis of hemophilia is so far unfavorable that more than half of the cases of pronounced hemophilia die in the first years of life and only a very small number grow to puberty. After puberty the prognosis becomes much more favorable. Hemophilics acquire a great tolerance for losses of blood, as if from habit, and often regain their strength with remarkable rapidity. The systematic cutting through of the tissues in surgical operations is tolerated much better, relatively, than accidental lesions, and extensive traumas bleed relatively less than slight ones. An arterial hemorrhage is much more easily arrested than a parenchymatous one where no vessel can be seen.

The treatment of hemophilia must, in the first place, be a prophylactic one. In accordance with the hereditary law of Grandidier, female members of hemophilic families must be advised not to marry; the males may marry if they themselves are not bleeders or if the study of their genealogy does not reveal deviations from the hereditary law unfavorable for the hemophilic fathers.

Of importance is the hygiene of hemophilics. All surgical intervention not absolutely necessary is to be avoided, though vaccina-

tion may be performed without hesitation. In the entire mode of life, from the nursery to the choice of profession, prophylactic measures in avoiding injuries of any kind must be observed. This applies, too, to the diet. No hard crusts of bread must be eaten, and no fruit stones be taken into the mouth, since slight scratches may easily lead to hemorrhages from the gums. A sojourn in the country, sea baths, vegetable diet, abstinence from alcohol and coffee, often aid in the treatment, but the medicinal treatment, taken altogether, is of no effect in improving the diathesis. The treatment of hemorrhage in hemophilia is a very difficult undertaking. Elevation of an injured limb, slight compression, ice, and tamponade, rubber bandages, the local use of adrenalin, calcium chlorid, and thrombokinase, further, compression or ligature of the afferent artery, may have to be considered. Sahli warns us against the subcutaneous use of gelatin and against the internal and subcutaneous administration of adrenalin.

Traumatic Hemorrhage in the New-born.—Cutaneous hemorrhage in the new-born is of itself of little importance. It is usually petechial and due to an excessive venous stasis, as may be produced in the course of labor, from asphyxia or compression of the umbilical cord. Intracranial hemorrhages occurring in the brain or meninges are very dangerous. Symptoms of pressure on the brain develop at once or after hours or days and lead sometimes to eclamptic attacks. Severe cerebral disorders may remain permanently after such a trauma intrapartum. The hemorrhages are in most cases under the arachnoid membrane and may be diagnosed with certainty *intra vitam* by lumbar puncture, if changed, deformed red blood-corpuscles can be found in the cerebrospinal fluid; fresh erythrocytes occur occasionally in any lumbar puncture through the injury of a small vessel. Moreover, muscular, pulmonary, and retinal hemorrhages may be observed on injuries during labor. Two seats for traumatic hemorrhage in the new-born have still to be mentioned, the cephalhematoma and the hematoma of the sternocleidomastoid muscle.

Cephalhematoma.—Most cephalhematomas lie under the periosteum and never extend beyond the suture of the bones of the head, since there the periosteum is adherent. The blood effusions located under the galea aponeurotica are not restricted by these limits. If the hematoma remains sterile recovery results rapidly, best with a protective dressing. If from infection abscess formation has developed, a broad opening should be made as soon as signs of inflammation are discovered, on the skin covering the swelling. To incise or puncture a sterile hematoma is inadvisable from the danger of infection. On fracture of the bones of the skull or in the presence of a congenital fissure the blood extravasation may extend under the dura, producing in this way symptoms of brain pressure.

Hematoma of the Sternocleidomastoid Muscle.—A rather harmless injury occurring usually on the manual delivery of a child with pelvic presentation is the subcutaneous rupture of fibers of the sternocleidomastoid muscle. In a few weeks complete healing and resorption of the blood extravasation occurs. The latter may be aided by massage, and at the same time the development of the caput obstipum be prevented by passive movements of the head.

Omphalorrhagia and the Hemorrhagic Diathesis of the New-born.—Umbilical hemorrhages of the new-born deserve careful attention. They may be divided into the following three groups:

1. Arterial hemorrhage from the stump of the umbilical cord soon after birth.

2. Vascular hemorrhage from the umbilical wound.

3. Parenchymatous hemorrhage from the umbilical wound after days.

1. Since the changed circulatory conditions after birth normally cause the blood stream in the umbilical vessels to cease, a hemorrhage from the surface of the section of the cord must depend on one of two conditions: the filling of the umbilical vessels with blood has abnormally persisted, or the ligature has been applied too loosely or has loosened itself after hours from the shrinking of the cord. The causes for the abnormal change in blood pressure may be a congenital heart failure or an insufficient expansion of the lung, which is frequently the case in debilitated children who do not cry vigorously, also in aspiration of liquor amnii and in atelectasis. To this factor must be added the blood-pressure-increasing action of the asphyctic blood.

2. In those rare cases where the lumen of the umbilical vessels remains open within the abdomen arterial hemorrhages may occur, even after days, when the umbilical stump is cast off.

3. In most other cases parenchymatous hemorrhages of the umbilicus are observed in the course of the first or second week, rarely later. They always announce a very severe condition, severe septic general infection, congenital syphilis or other fetal diseases. Not only umbilical hemorrhages, but also gastrointestinal, renal, nasal, and cutaneous hemorrhages and those of the mucosa are then observed, especially in septic processes. All endeavor to arrest the hemorrhage is fruitless, and death occurs usually after a few days. In gastrointestinal hemorrhages melena neonatorum must be thought of; in septic processes, however, the hemorrhage begins usually as a slight one and increases only gradually, not becoming fatal, as in melena, from its intensity, but from its obstinacy. In the epistaxis of infancy the two most frequent causes must be thought of, syphilis and nasal diphtheria. Beside the local syphilitic proc-

esses of the nose, there exists a specific, syphilitic hemorrhagic diathesis of the new-born, which leads not only to epistaxis, but to all other forms of hemorrhages. The morbid changes of this condition consist in a severe syphilitic affection of the vessels, especially of the capillaries and veins, while the arteries are affected only to a slight degree. The infiltrations of the vessel walls and proliferations of the intima are in some places so marked that a complete obstruction of the vascular lumen results; again other less intensely affected vascular regions remain full of blood. The cause of the hemorrhage lies first in the insufficiency of the organsim to establish its own circulation, leading to stasis of the stream and secondly in the anatomical changes of the vessel walls.

In the family trees of hemophylics, reported by Grandidier, cases of death in the new-born from umbilical hemorrhage can be found. The prognosis of umbilical hemorrhage depends on the primary disease and chiefly on the mode of feeding. Children nursed by the mother may overcome even severe septic processes. The hereditary luetic and septic diatheses give the worst chances; and the most favorable course, relatively, is to be found in pyocyaneus septicemia. In hemorrhage of the umbilical cord ligature should be performed immediately. If the cord has fallen off and the vessels persist in bleeding, acupressure must be tried. Thermocauterization, gelatin injections, cotton dipped in ferric chlorid, adrenalin, and filling of the umbilical wound with calcium sulphate or phosphate may be tried, but in the great majority of cases all these attempts will be useless. If syphilis is suspected, the specific treatment is at once to be instituted. In all cases feeding with human milk must be emphasized where it is the last and only hope of recovery.

Melena Neonatorum.—Melena neonatorum is a very much dreaded disease, consisting in bloody vomiting and in the appearance of bloody stools; from this melena vera, characterized by gastrointestinal hemorrhages, we have to distinguish the melena spuria, or false melena, in which we have to deal with swallowed blood. To avoid this diagnostic error, the nose and the oral and pharyngeal cavities of the child and the nipples of the mother must be carefully examined. Melena begins often on the first day after birth, usually between the second and fourth day, scarcely ever after the first week. The stools are at first still mixed with meconium and are tar-colored. Also the blood vomited from mouth and nose is usually blackish, but vomiting may sometimes be entirely absent. The course of melena is usually very violent, severe prostration may have developed through the profuse loss of blood in a few hours. The fontanels are sunken, the skin becomes pale and cool, the nose pointed, the pulse not palpable, and the child dies in convulsions, due to the cerebral anemia.

In 56 per cent. of all cases the hemorrhage ceases, and in lighter cases the child may recover rapidly, but sometimes only very slowly. Death may occur after days from exhaustion, atelectasis, or bronchial pneumonia. The pathogenesis of melena is as yet not clearly understood. The conception that we have to deal with hemophilia is refuted by the normal condition of those children who have overcome the melena in the later periods of life. A septicemia or congenital syphilis may pursue a course resembling melena; however, this symptomatic melena must be distinguished from the primary disease, which is found in otherwise entirely healthy children. The ulcerative processes which have been found in stomach and duodenum are not to be considered as the cause of the hemorrhage, but they have themselves developed on the ground of blood extravasations into the mucous membrane, so frequent in this condition. Stasis may favor the development of melena. In congenital affections of the heart and large vessels and in liver syphilis there may result general or portal stasis, respectively, ending in melena. In the same way the condition may be produced by compression of the umbilical cord during labor, by atelectasis and asphyxia postpartum and perhaps, too, by intracranial hemorrhages, through paralysis of the vasomotor center. This latter conception is justified, if convulsions and other symptoms of brain pressure complicate the picture and if the lumbar puncture shows disintegrated erythrocytes in the cerebrospinal fluid.

The prognosis is serious, but energetic therapeutical intervention may save the child, even in desperate cases.

Gelatin has proved an excellent remedy. It is given internally, in a 2 to 5 per cent. solution, one tablespoonful every two hours. One hundred grams of a 5 to 10 per cent. solution may be given mornings and evenings as clyster, and in urgent cases about 15 c.c. of a 2 to 10 per cent. gelatin solution may be injected subcutaneously. Ergotin and adrenalin have their warm partisans. [*Editor's Note.*—Normal horse serum in subcutaneous injection has in recent times been used with excellent results in the hemorrhagic diathesis, especially in hemophilia and melena.]

Human milk, cooled on the ice, is the best food. The external application of ice is not advisable, for it increases the danger of collapse and stimulates peristalsis. On the contrary, we must protect such a child against any loss of heat. If collapse has once occurred the subcutaneous infusion of 100 gm. physiological salt solution may be tried once or twice a day; besides, we will use heat and the common stimulants.

Winckel's and Buhl's Diseases.—A condition very interesting clinically, frequent in new-born domestic animals, but rare in human

beings, is Buhl's disease, or the fatty degeneration of the new-born. A parenchymatous, later fatty, degeneration of liver, kidney, and cardiac muscles develops in the first days after birth; the vomiting of blood, melena, and umbilical hemorrhage, extravasations in the external skin and mucous membranes, anemia, and jaundice occur, leading to death usually before the end of the second week.

Regarding its etiology, we must ascribe this condition as well as Winckel's disease, which occurs epidemically, and leads in a short time to collapse and death with cyanosis, jaundice, and hemoglobinuria, to septicemia. Intestinal hemorrhages are absent, whereas epidural blood extravasations and punctiform ecchymoses in almost all organs may be found; fatty degeneration, as in Buhl's disease, is here also a constant finding. In both conditions, especially in Winckel's disease, all treatment is rather hopeless. We may try to arrest the hemorrhage, but we will restrict our action chiefly to the combating of collapse by excitants, as ether, musk, and camphor; the loss of heat will be prevented by wrapping the body in warm sheets or placing the child in an incubator.

Hemorrhage and Visual Disturbances.—As far as the symptoms are concerned which are produced by hemorrhages in the nervous system and sense organs, the sequelæ of acute cerebral anemia will be discussed in the chapter on Syncope and those of intracranial blood extravasations in the chapter on Symptoms of Nervous Irritation and Paralysis.

Posthemorrhagic anemia, as well as chlorosis, leads to disturbances in vision, which are sometimes due to weakness of the muscles of accomodation or of the internal recti muscles, necessary to convergence, sometimes to the insufficient blood supply of the cerebral cortex and retina or to complications. On opthalmoscopic examination the retina itself is found to be exceedingly pale, the blood in the vessels bright red, and sometimes a marked pulsation of the vessels may be seen. Optic neuritis and edematous infiltration of the papillæ may develop, resembling a choked disk. Sudden blindness does not occur very rarely after severe hemorrhages; the prognosis of this amaurosis is only favorable if on a lowered position of the head a sufficient circulation is soon established. Terson was able to save the sight in such a case by the subcutaneous infusion of physiological salt solution. Hemorrhages of the retina, and especially of the vitreous humor, are by no means rare in severe anemias, chiefly in pernicious anemia. In leukemia, retina and choroid are not rarely infiltrated with blood, which from the preponderance of leukocytes is strikingly pale. In the hemorrhagic diatheses blood extravasations of various kinds develop into the retina, choroid, and, more rarely, the sclera. Visual disturbances from eye diseases of another nature, as from ulcer of the cornea

or neuritis, are rare in hemorrhagic diseases. The conjunctiva may be the seat of severe hemorrhages, especially in hemophilic children, indeed it may be the only localization of the condition. Retinal hemorrhages developing intrapartum are probably due to the excessive venous stasis. Subconjunctival hematomata of great extent are sometimes observed in whooping cough, giving a frightful appearance to the patient. If they develop spontaneously at a later age, they point to arteriosclerosis, contracted kidney and other conditions associated with hypertrophy of the left ventricle.

Hemorrhages and Disturbances of Hearing.—Disturbance of the auditory sense is found in apoplectic individuals more frequently than that of the other senses. It is especially frequent in hemorrhage into the pons, but generally the deafness is not complete. Hemorrhages of the auditory organs may be caused by hyperemia or embolic processes, by trauma, caries, and necrosis, by constitutional diseases, acute inflammation of the middle ear, and disturbances of menstruation. They become dangerous only when large vessels, as the internal carotid, jugular vein, and transverse sinus are eroded. However, the carotid canal may be extensively destroyed without causing an opening of the artery. Hemorrhages in the labyrinth have been described after fracture of the petrous portion of the temporal bone, as well as after concussion.

The treatment of hemorrhage from the ear consists in tamponade, in which hemostatic cotton may be used; in syringing out the ear with very warm or very cold water, and in severe cases in compression or even ligature of the common carotid artery.

Simulated Bleeding and Hemorrhages of Neuropathics.—Not only may hemorrhages exert an influence on the nervous system or the organs of sense, but nervous diseases of different kinds may, of themselves, cause hemorrhages. Simulated hemoptysis is observed in hysterical individuals. The blood is sucked from the gums or derived from the bronchial mucous membrane, small vessels being ruptured by the violent attacks of cough so frequent in hysteria; undoubtedly the hysterical may have true pulmonary hemorrhages, which bear a direct relation to their nervous condition, just as cutaneous hemorrhages, monthly bleeding from angiomas and from polypous growths in the tympanic cavity may appear periodically without any intervention on the part of the patient. Sticker relates a remarkable case where, in an hysterical woman, a wart on the right upper arm began to bleed at the time of each menstruation. This vicarious hemorrhage ceased from the moment an anesthetic zone on the right shoulder was caused to disappear under faradic treatment. In mental diseases (maniacal states of excitation, progressive paralysis) rare cases of pulmonary hemorrhage occur, probably due to arteriosclerotic changes.

After severe paralytic attacks small hemorrhages may be found all over the skin and mucous membranes and in the parenchymatous organs. Thus tubercular changes in the lungs cannot always be blamed for the hemorrhages from the lungs in epileptic attacks. They are a consequence of the much impaired venous blood flow, which at the same time may lead to epistaxis and to very small petechiæ, especially on the skin of the chest. Charcot described ecchymoses on the surfaces of the lungs and endocardium on postmortem examination, after focal lesions in the brain. Rilliet and Barthez found hemorrhagic centers in the lungs in tubercular meningitis, and Ollivier after brain lesions on the contralateral side of lung and pleura.

Hematoma of the Ear.—Othematoma, the hematoma of the external ear, is frequently found in the insane. It is a fluctuating blue-red tumor usually situated on the upper and outer part of the pinna. The blood is resorbed after months, but the perichondrium shrinks, leading to a persistent deformity of the ear. It is the manifestation of a severe vasomotor disturbance, as found in advanced cases of progressive paralysis, in which a paresis of the vasoconstrictor fibers of the trigeminus develops. Other authors believe the hematoma auris to be an inflammatory process, like the hemorrhagic pachymeningitis. Still others believe in its traumatic origin. In healthy persons the othematoma is not met with, though Krafft-Ebing reports that he once found it in a mentally healthy individual. In his family, however, there were several mentally deficient, so that he had to be considered as abnormal, *ab origine*, if not as a decidedly psychotic individual. A process similar to the othematoma has been described on the nasal cartilages as rhinhematoma.

Hemorrhages of Organ Parenchyma usually not Diagnosed Intra Vitam.—Pancreatic Hemorrhages.—Several kinds of hemorrhages exist which during life may only be suspected but not diagnosed, but which show very remarkable findings postmortem. First pancreatic hemorrhage; slight extravasations of blood are found, not infrequently in all diseases leading to hemorrhages in other organs. Klebs believes that tryptic digestion is the pathogenic factor in this hemorrhage. Also more extensive blood extravasations found in the pancreas postmortem may have no connection with the picture of this disease and the fatal ending, though it may be suspected that injury of the semilunar ganglion by the pancreatic hemorrhage has produced, reflexly, the standstill of the heart. There are, however, a great number of cases related where an abundant apoplexy of the pancreas was the only finding which could in any way explain the death. One of the most frequent causes of these hemorrhages is believed to be a diseased condition of the vessels, whether we have to deal with arterio-

sclerotic or syphilitic changes or with contracted kidney. Fatty degeneration of the glandular parenchyma, a deposition of fat in the gland, or fat necrosis have further to be considered; also hemorrhage from decomposing tumors or from cysts, embolic processes, trauma, and inflammatory processes tending to hemorrhages—the hemorrhagic pancreatitis—deserve our consideration. In what way the pancreatic hemorrhage kills is not yet understood. In the majority of cases the determining factor will not lie in the quantity of blood lost, but rather in the nervous shock produced by the irritation of the sympathetic plexus, which, the analogue of Goltz' trauma experiment on the frog, leads to a standstill of the heart in diastole. Death may occur at once or after hours. On postmortem examination neither the loss of blood nor the destruction of the entire pancreas can be considered as *causa mortis*.

The disturbance of the internal secretion of the gland may perhaps be the fatal factor, though animals may live for some time after complete extirpation of the pancreas. Pancreatic hemorrhage occurring repeatedly may last for weeks and months, ending in putrefaction and peritonitis or in recovery by spontaneous healing after the necrotic portions of the gland have been expelled through the intestines. Pancreatic hemorrhage cannot be diagnosed definitely, but it may be suspected after trauma on the epigastrium if a tumor develops with violent pain and symptoms of internal hemorrhage. Without the tumor, one would as well think of peritonitis by perforation, intestinal occlusion, or a peritoneal abscess. In chronic cases in which cysts or abscesses develop, surgical intervention is possible; in acute cases it is contraindicated by the collapse. Nothing can be expected from internal treatment.

Suprarenal Hemorrhage.—Hyperemia of the suprarenal glands, whether congestive or venous, may lead to hemorrhage. This is seen very nicely in the experimental diphtheria of guinea-pigs, where hyperemia and ecchymoses of the suprarenal glands are important symptoms for diagnosis. In all diseases leading to general venous stasis, the suprarenal glands may be strongly hyperemic and infiltrated with small hemorrhages. These findings occur, therefore, very regularly in the new-born who have died from asphyxia during labor. The hemorrhage may be so intense that the entire gland on one side or on both sides may be transformed into a sac filled with blood, attaining in the new-born the size of a hen's egg. Beside the venous stasis due to asphyxia, compression of the umbilical cord or of the inferior vena cava between liver and spinal cord may lead to suprarenal hemorrhage intra partum. In later life lues, convulsions, very acute infections, thrombosis of the renal veins and of the inferior vena cava, malignant neoplasms, constitutional anomalies, burns,

and blows on the back have to be considered as etiological factors. The hematomata may be encircled by suprarenal substance; resorption, shrinking and calcification results or apoplectic cysts may form. Such sacs, filled with blood, may in the adult reach the size of a man's head. Perforation into the free abdominal cavity and thereby death from internal hemorrhage may occur. Stoppage of the adrenal secretion leads to Addison's disease, as is well known. In these cases the time was probably too short for the disease to develop. Surgical intervention is possible only if a definite diagnosis has been made.

Hemorrhage into the Thyroid.—Injuries to goitres by dull or sharp objects often produce very severe hemorrhage into the glandular tissue or into cystic cavities. This latter occurrence is not infrequent on account of the pronounced tendency to bleeding, so that often, on exploratory puncture, a brownish fluid is obtained from the cyst, due to old hemorrhages. The rapid growth of the gland sometimes causes diagnostic doubts as to whether we have to deal with an acute strumitis or with malignant goiter. However, the acute strumitis is characterized by positive bacteriological findings in the blood and by fever, the malignant neoplasm by extension into the neighboring organs. The exploratory puncture may sometimes be followed by very undesirable suffusions which occasionally may extend to the hypogastric region.

Hemorrhage following Tonsillotomy.—Hemorrhages following tonsillotomy, though not exactly belonging in this chapter, may be mentioned here in a few words, since the operation is often performed by the practitioner and the hemorrhage may assume dangerous dimensions. Prophylactically, Zuckerkandl advocated not to extirpate the tonsils, but only to amputate them, as in this way arterial hemorrhages of the branches of the tonsillar artery are more easily avoided. However, in considering the pathological physiology of the tonsils, which are one of the chief points of entrance for local as well as for systemic infections, tonsillectomy will have to be preferred to tonsillotomy.

For the hemorrhage ice-water may first be tried. Stoerk warns against the use of astringents, especially of chlorid of iron, but advises digital compression and, if necessary, suture of the anterior and posterior palatine arch by two or three ligatures.

Apoplexy of the Thymus (*"Thymus Death"*).—After complicated labor hemorrhage into the thymus gland may occur. The formation of cysts and syphilitic changes in the vessels may be predisposing factors. Such a hemorrhage may be the immediate cause of death, whether through the cessation of the internal secretion or through the excessive enlargement of the volume of the gland which presses on the large veins or vital nerves, as vagus, sympathetic, phrenic.

Increased dulness over the sternum may lead to the diagnosis. The normal dulness of the thymus forms a triangle whose three angles lie in the sternoclavicular articulation and in a line corresponding to the sternal insertion of the second rib; the triangle extends somewhat beyond the sternum to the left. If this dulness is increased by 1 cm. an enlargement of the thymus may be supposed. This rare condition is, however, of more interest to the medicolegal officers than to the clinician, for at present there is no treatment. [Editor's note.—In recent times thymectomy has been successfully performed in several cases of children between five and twelve years of age.]

CHAPTER XIV

EXAMINATION OF THE BLOOD

INTRODUCTION

Primary and Secondary Diseases of the Blood; Necessity of Blood Examination.—Many diseases of the blood lead to severe disorders of vital functions, and in many other diseases the coinvolvement of the blood produces a series of symptoms of more or less gravity. Though certain changes of the blood may be recognized by mere inspection of the general integuments and visible mucosæ, the preponderating number of pathological changes of the blood can be diagnosed only after a minute hematological examination. This often gives valuable information in cases where the condition of the blood seems to play an inferior rôle in the symptom-complex. Without its control no final statement should be made as to the quality of the blood of any individual. Thus it is common to diagnose anemia from the pale look of a patient. This pallor is a symptom very common in nervous people, because their cutaneous vessels are constantly in a state of contraction, producing thus the impression of a blood disease, whereas examination shows a normal condition.

THE RED BLOOD-CORPUSCLES UNDER NORMAL AND PATHOLOGICAL CONDITIONS

(*a*) **Normal.**—In Adults.—The quantity of blood in adults corresponds to about one-nineteenth of the body weight. One cubic millimeter of blood contains about 5,000,000 red blood-corpuscles, somewhat more in males and somewhat less in females, and 5000 to 10,000 leukocytes. One hundred cubic centimeters of blood contain about 14 gm. hemoglobin; the specific gravity of the blood is 1055 to 1060.

In Infants.—These figures are all higher in the new-born. The number of red blood-corpuscles varies between 5,500,000 and 7,500,000; the white corpuscles, too, may be considerably increased, up to 30,000; the hemoglobin content may be 100 to 140 per cent. (Fleischl), the specific gravity may be 1080. In the first few days after birth these figures decrease considerably, then more slowly; and in infancy the leukocytes are only a little higher than in later life. In the first years of life there already develops that relation of the chief constituents which is found in the adult.

(*b*) **Plethora Vera and Serosa.**—Of pathological variations we have first to consider an augmentation of the total quantity of blood, plethora vera or plethora serosa. In the first case all constituents of the blood are equally increased, in the latter only water and salts. The question whether or not a pathological superabundance of blood exists has long been discussed. One observes that the organism destroys excessive quantities of human blood which have been infused, though not so rapidly as it does heterogeneous blood. Even a relative excess of the individual's own blood is not of long duration; it is sometimes produced after amputations performed by Esmarch's bloodless method, and in the new-born after delayed ligature of the umbilical cord, where an excess of blood, even 100 gm., may be demonstrated by weighing.

These conditions are very different from those in plethora vera, due to persistent overfeeding. Clinically, a full pulse of high tension and symptoms of hyperfunction and hypertrophy of the heart may be found; and the postmortem examination confirms the suspicion that an enormously large quantity of blood was present, resulting in a general dilatation of the blood-vessels. In earlier times it was the custom to bleed such persons at regular intervals. There is no doubt that this procedure has been found beneficial, and it is still an open question if there are not cases where venesection is really indicated. At any rate, moderation in eating and drinking must be urgently advised in such cases.

Plethora serosa is fundamentally different from plethora vera. A too abundant intake of liquid can be blamed only in very transient cases. If the condition lasts for more than a few hours we have certainly to deal with an impaired output of water, due to renal or cardiac insufficiency.

(*c*) **Hydremia.**—Hydremia, a relative increase of water in the blood by continual loss of proteids, develops after any severe hemorrhage, since water and salts are first recovered. As in plethora serosa, the specific gravity and dried residua of the blood are decreased.

(*d*) **Anhydremia.**—The contrary condition is anhydremia, an inspissation of the blood. Specific gravity and dry residua are increased; the cellular elements and hemoglobin content show relative augmentation. Hayem counted six and one-half millions red blood corpuscles per cubic millimeter in these cases. The inspissation of the blood occurs if the ingestion of liquids is hindered or if the output of water through skin, lungs, or intestines is increased (heat stroke, Asiatic cholera). Children especially are inclined to exsiccation, chiefly from the disproportion between surface and volume in favor of the first. The highest degree of exsiccation, with deep retracted fontanels and overlapping bones of skull, are found in profuse

diarrhea and frequent vomiting, especially if high fever increases the loss of water through skin and expiration.

Increase of Blood-corpuscles at High Altitudes.—The question whether a sojourn in the mountains has a direct influence on the composition of the blood has been very much debated. It has not been proved that the well-known increase of cellular elements is a true one, as increased evaporation of water and the pressing out of blood plasma through the contracted blood-vessel might have the same effect. Abderhalden, in his morphological studies, failed to find any new formation of cells, though the rise was so fast that the number of erythrocytes in the cubic millimeter increased over one million in one to two days. A complete parallelism could be observed between the number of erythrocytes and the hemoglobin content.

(*e*) **Changes in the Erythrocytes in Secondary Anemia.**—The diseases in which the number of erythrocytes are diminished are legion. Single severe hemorrhages or repeated small ones, faulty hematopoiesis, and increased disintegration are the general causal factors. The total quantity of the blood scarcely sinks from loss of blood, as the liquid is always rapidly replaced. In this sense there exists no posthemorrhagic anemia, but only a posthemorrhagic oligocythemia and hydremia. But also a true anemia, the counterpart of plethora vera, may develop, if nourishment and hematopoiesis are insufficient, as in carcinoma of the stomach and pernicious anemia. Any morbid condition leading to emaciation produces a greater or smaller decrease of the cellular elements of the blood. But it is easily understood that certain conditions will alter the quality of the blood especially. The plasmodia of malaria destroy the erythocytes directly by their invasion; carcinoma by its specific cell toxins. Syphilis, especially the congenital form, tuberculosis, chronic nephritis, bothriocephalus latus, before all the anchylostoma duodenale, and even ascarides and trichocephalus, usually considered harmless, may have at times a component in their action injurious to the formation of blood. Many of the well-defined chemical poisons, as lead, arsenic, mercury, potassium chlorate, pyrogallol, phenacetin, and others, have a similar effect.

Following Loss of Blood.—*Acute.*—After severe losses the blood can be recognized even macroscopically as rich in water and impoverished in cells, from its light color, thin quality, and deliquescence. Even after the removal of less than 100 c.c. of blood, the increased water content can be demonstrated. The number of erythrocytes is decreased, and this becomes still more conspicuous in the next few days, when the liquid lost has been regained. As signs of regeneration, fetal types (as macrocytes, and nucleated red blood-corpuscles) are soon found. The regeneration of cells is accomplished faster than the

increase in the hemoglobin, for the newly formed cells are poorer in coloring matter. Complete restitution may be accomplished within a month, even after severe hemorrhages, but it is retarded in chronic diseases, as tuberculosis.

Chronic.—The new formation of blood after small repeated losses is not so energetic as after one large hemorrhage. The blood picture is similar, only the poverty of the newly formed cells in hemoglobin is striking, as well as the morphological changes, such as poikilo-, macro-, and microcytosis, which point to degeneration of the hematopoietic organs. Single, nucleated red blood-corpuscles attest the endeavor of the bone marrow to cover the loss. The regeneration is slower the longer the anemic condition has lasted.

Effect of Blood Poisons.—Loss of red blood-corpuscles may be due directly to the action of blood poisons, which may either directly dissolve them, resulting in hemoglobinemia and hemoglobinuria, or which may cause an increased destruction of the erythrocytes in those organs where they are destroyed normally. We have here to deal with the toxins of many infectious diseases, certain poisons introduced from without or formed in the intestinal canal, the hypothetical chemical noxæ of malignant tumors, and the metabolic products of intestinal parasites. The blood picture in these cases usually resembles that of secondary anemia, but occasionally may be the same as in pernicious anemia.

In Fasting and Insufficient Nutrition.—"Acute complete abstinence from food will not produce anemia" (Ehrlich-Lazarus). The blood participates in the general emaciation, but no disturbance in the relation of its elements arises. However, after nourishment is again taken, the cellular regeneration of the blood is inferior to its gain in water, resulting in a period of relative oligocythemia. Similar is the relation in insufficient nourishment, whether the calorific requirement or the demand for proteids or, especially in childhood, that for iron is not covered. In the last instance the impoverishment in hemoglobin is very conspicuous; thus, in children who are fed at the breast exclusively longer than the first year the milk, through poverty in iron, becomes insufficient, because the reserve stock received at birth has been used up (Bunge).

In Respiratory Poisons.—Absence of fresh air and of sunlight injure the hematopoietic power, as recognized chiefly in the growing organs by the decreased number of erythrocytes and by the low color with slight morphological changes. This is the common anemia of rachitic individuals and school children.

(*f*) **The Red Blood-Corpuscles in Primary Diseases of the Blood.**—Simple Chronic Anemia.—Simple chronic anemia is in the greater number of cases an associated symptom in other diseases; for every

disease, by the loss of appetite, fever, and the absence of fresh air, tends to produce anemia. The increase of hydrobilirubin in the urine, according to Viglezio, indicates the deleterious action of the injurious noxæ upon the erythrocytes. Beside febrile diseases, gastro-intestinal disorders are most frequently associated with anemia. In the simple chronic anemia the blood differs from that in chlorosis, in the parallel decrease of hemoglobin and the number of erythrocytes; for while in chlorosis the hemoglobin content is found to be much lower than would correspond with the number of erythrocytes, this disproportion is never so pronounced in secondary anemia.

Progressive Pernicious Anemia and Bothriocephalus Anemia.—The progressive pernicious anemia, first described by Biermer, is a condition of entirely unknown etiology, except in those cases, where the presence of Bothriocephalus latus in the intestines has led to this severe complex of symptoms. Removal of the parasites leads in some cases to recovery; in others, it is too late to arrest the fatal course of the disease. Pregnancy and labor seem to favor the development of this disease, even when hyperemesis or severe hemorrhage is absent. In general, all injurious factors leading to simple anemia may sometimes incite progressive anemia. Heubner believes that a cryptogenic, occult septicemia is probably the etiological factor in these cases. The number of red blood-corpuscles may fall below 1,000,000 and the amount of hemoglobin to 20 per cent. or lower. The color index shows the opposite condition to that in chlorosis. Hayem called attention to the increased capability of the individual erythrocyte of being stained. On a suspicion of pernicious anemia, one therefore will look for large erythrocytes, rich in hemoglobin. Beside, we find constantly, a small number of nucleated red blood-corpuscles, exceeding the size of a normal cell two to four times (megaloblasts). The appearance of numerous karyokineses in the blood is generally of bad prognosis. On the other hand, we take it as a favorable symptom if, gradually, more and more normoblasts take the place of the megaloblasts; this may be observed in Bothriocephalus anemia after removal of the parasites. The presence of microcytes is common to progressive pernicious anemia and to the simple chronic forms.

(*g*) **Leukemic Blood Picture.**—Acute Lymphatic Leukemia.—Sometimes a severe disease develops with rapidity, in which decrease of the red cells and increase of the white ones develop to such a degree that the relation is not more 1 : 500, but may become 1 : 20, and indeed even 1 : 3. This increase involves the lymphocytes exclusively, and especially the large ones. The number of red blood-corpuscles rarely sinks below 1,000,000, the hemoglobin usually falls below 50 per cent. These blood findings may be found at the onset of the first symptoms,

and show, on further course, a rapid augmentation of the lymphocytes; in some cases the patient gives an impression of a severe anemia or pseudoleukemia, until, a few days later, the leukemic blood picture has become unmistakable, being followed in a short time by death (leukemia acutissima).

Chronic Lymphatic Leukemia.—In the chronic form, the red blood-corpuscles are usually markedly decreased in numbers and vary considerably in size and form. Nucleated red cells are much more rare than in the spleno-myelogenous form, and may even be completely absent. The number of lymphocytes is enormously increased, sometimes to 500,000 and more.

Mixed-cell Leukemia.—Beside lymphatic leukemia, another form is found characterized by an exceedingly variegated blood picture, which formerly was known as "myelogenous leukemia." Today, when we know that every leukemia is due to a diseased condition of the bone marrow, the term "mixed-cell leukemia," proposed by Pappenheim, is preferable. The involvement of spleen and lymphatic organs must not be overlooked. Beside the normal leukocytes, primary stages of the ripe leukocytes, otherwise found only in the bone marrow, appear in the blood: mononuclear eosinophiles, numerous myelocytes, small lymphocytes, and mononuclear cells with basophile granules are found. A great number of mononuclear granulated cells, though found in many other conditions associated with irritation of the bone marrow, as, for instance, in carcinoma ventriculi, will always arouse a suspicion of the presence of leukemia, even if the total number of leukocytes is not exceedingly high. Ehrlich considers the mononuclear leukocytes with neutrophile granules characteristic, especially in the initial stage, but also the eosinophiles and basophiles are absent only in rare, atypical forms of leukemia. A lighter degree of increase of leukocytes is by no means always a favorable sign. On the contrary those cases with diminution of red and white cells in which only the relative increase of large atypical leukocytes substantiates the diagnosis, must be considered very unfavorable ones (aplastic leukemia of A. Wolff).

Diagnosis of Leukemia.—The diagnosis of leukemia depends not merely on the disproportion between the red and white cells, for other processes leading to the destruction of erythrocytes, as hemoglobinuria, may produce similar relations; nor can the absolute number of the white cells alone be considered pathognomonic in cases not very pronounced. The important factors are the morphological changes in the leukocytes; and their number can be used only to a certain degree in judging of the severity of a case. For there are lymphatic leukemias in which the total number of leukocytes is normal or

decreased until death. The combination of leukemia and pernicious anemia Leube called leukanemia.

Rarity in Childhood.—If leukemia is a rather rare disease in adults, it is still more the case in childhood; the lymphatic form is the most frequent. Lommel described a case of congenital leukemia in which after four weeks the proportion of red cells to white was 1 : 1.

Influence of X-rays.—Of great interest is the action of the X-rays on spleen and bone marrow, first proposed by Nicholas Senn in 1903. By its use the number of leukocytes may be brought down to normal, as, for instance, from 76,000 to 5200. The morphological picture of the leukocytes approaches the normal, the red blood-corpuscles increase in number, the hemoglobin rises, the spleen and the lymph glands become smaller, and the general condition is improved. However, we will do well not to consider these changes too optimistically. The infiltration of the cutis, developing under the influence of the irradiation, leads perhaps to the accumulation of leukocytes in it (Rosenbach). At any rate, the activity of the bone marrow seems to be intensely stimulated by the X-rays. This view is supported by the observation of Rénon and Texier, that the normoblasts are increased by the use of the X-rays in pernicious anemia. This action of the rays, however, is not to be found in normal bone marrow.

(*h*) **The Blood in Pseudoleukemia.**—In pseudoleukemia the red blood-corpuscles are considerably decreased and, parallel with this, the hemoglobin content. The lymphocytes are relatively increased, which, according to Ehrlich and Pinkus, distinguishes the blood picture from that of lymphosarcomatosis and other forms of lymphomatoses. The total number of leukocytes may be moderately increased, the increase usually corresponding with a period of exacerbation of the condition.

In Anemia Pseudoleukemica Infantum.—The anemia pseudoleukemica infantum is a severe anemia with enlarged spleen, which develops at the end of the first year of life and reaches its greatest intensity in the following two years. The number of red blood-corpuscles may fall to the half, the hemoglobin to the third of the normal. The number of white cells is moderately increased. Some authors have described the relation of the white to the red as 1 : 20. Poikilocytosis with macro- and microcytes is present in an extreme degree, and an unusually large number of nucleated red cells, up to 20,000 in 1 c.mm. is present, of which a great number are of excessive size. It seems as if the output of fetal cells from the bone marrow is more easily accomplished in the child than in adults. The leukocytes differ only slightly from the normal, the lymphocytes being somewhat

increased in number, some neutrophile and eosinophile myelocytes being present.

(*i*) **In Chlorosis.**—Chlorosis, an anomaly of the blood, occurring chiefly in young girls at the period of puberty, is characterized by the low hemoglobin content of the blood with or without a decreased number of red cells. The specific gravity of the blood is at the same time considerably lowered, being sometimes below 1040, generally lower than 1050. The red blood-corpuscles are very pale in severe cases, large, their concave depressions only slightly marked. Signs of degeneration and regeneration in the erythrocytes as well as changes in the leukocytes do not belong to the typical picture of chlorosis.

(*j*) **In Banti's Disease.**—A rare disease of the blood, developing from a primary affection in the spleen, is Banti's disease, "the splenomegaly with liver cirrhosis" in which anemia and leukopenia are present. The differential diagnosis from malarial anemia and lienal pseudoleukemia as well as from lues hereditaria often causes difficulty, especially in the first stage of the disease.

GENERAL TREATMENT OF BLOOD DISEASE

The differentiation of primary and secondary blood diseases is practically of great importance since most symptomatic anemias heal rapidly after removal of the primary evil; light, air, and an appropriate diet are the most important curative factors.

(*a*) **Dietetic.**—Whether the dietetic or the medicinal treatment is of more value depends entirely on the nature of the disease and on the state of nutrition of the patient. Patients with chlorosis often show a good state of nourishment and a well-developed panniculus adiposus. We will not accomplish much here with a purely dietetic treatment. On the other hand, an appropriate diet will sometimes rapidly improve the anemic condition of the convalescence after an exhaustive disease.

The food should be rich in proteins but well mixed. Yolks of eggs, spinach, asparagus, and green cabbage are the foods most rich in iron; after these come the leguminous vegetables. Milk, though poor in iron, is nevertheless an excellent food for anemic persons. A pathological increase of protein decomposition is present in pernicious anemia, as well as in leukemia. We will therefore further the nitrogen deposition by an appropriate diet, more in these diseases than in chlorosis and secondary anemia where there are no protoplasmic poisons.

(*b*) **Rest in Bed.**—Before speaking of the medicinal treatment we have to mention the great importance of the rest treatment in severe chlorosis. One observes not rarely that chlorotic girls are not relieved

from their condition, though every means is at their disposal and the quantity of iron they take is enormous. On closer observation we learn that, on the advice of some physician, they take much exercise in the fresh air. We observed in Nothnagel's clinic, a considerable increase in the hemoglobin content in two to six weeks in chlorotic patients in the wards by the rest treatment. In all severe anemias with the tendency to headache, vertigo, tinnitus aurium, swimming of objects before the eyes, and palpitation, rest in bed, with the upper portion of the body only slightly raised is, of course, necessary. Syncope and even amaurosis for several hours may be the consequence of careless getting up.

(*c*) **Medicinal Treatment.**—*Iron.*—Iron has for a long time been considered a specific remedy in all forms of anemia. The best results from it are seen in chlorosis. The action of iron is due to its assimilation and use in building up the hemoglobin molecule and to the stimulating effects which it exerts on the hematopoietic tissue. Iron acts much more readily in adolescence than later on. The number of iron preparations is exceedingly large. Niemeyer has emphasized that they must be easily digestible and capable of being given in large doses. One of the most used preparations is Blaud's pills:

Rp. Ferr. sulfur. oxydul
Kali carbon., āā 10.0
Pulv. tragacanth.,
Aq. dest., q. s.
M. f. l. a. pilul. No. C.
DS. One to three pills three times a day after meals.

Chlorotic girls of about twelve years of age tolerate well two to three of these pills two to three times a day. A more durable modification of Blaud's pills may be made by using sodium carbonate instead of potassium carbonate and cod-liver oil instead of water; inclosed in gelatin capsules, they do not deteriorate by the formation of hydrated oxid of iron. Another preparation which may be recommended is the ferrum pyrophosphoricum cum ammonio citrico, especially useful in children, and which may be given in doses of 0.2 to 0.5 gm. three times a day. Further, ferrum carbonicum saccharatum, in powders of 0.2 to 0.5 gm. three times daily, or the ferrum hydrooxydatum dialysatum liquidum, 5 to 10 drops three times a day. Monti uses for children especially:

Rp. Ferr. hydroxyd. dialysatum 1 : 90
Natr. chlorat., 1.00
Syrup. simpl., 10.00
DS. One tablespoonful three times a day.

A great number of organic iron compounds, as ferratin, hematogen, fersan, alboferin, ovoferrin, etc., have been brought on the market.

They have no advantage over the inorganic preparations, except for the manufacturer, by their high price.

Arsenic.—In progressive pernicious anemia, in leukemia and pseudoleukemia arsenic deserves the preference over iron. It is given in the form of subcutaneous injections of 1 mg. arsenic acid, increased slowly up to 1 cg., or internally as Fowler's solution, as the Asiatic pills or as arsenic-gelatin tablets. The natural arsenical water of Roncegno and Levico deserve recommendation. The treatment by arsenic should be tried as early as possible, the patient being kept under close observation. Cutaneous eruptions, pruritus pigmentation, gastric discomfort, diarrhea, and elevation of temperature can scarcely be avoided in a treatment with arsenic. It is completely contraindicated in dyspeptic chlorosis.

Quinin and Other Medicinal Measures.—In cases of anemia due to malaria or syphilis, quinin or iodin, respectively, will be indicated; in the anemia of rickets, phosphorus and cod-liver oil.

Organotherapy.—Organotherapeutic attempts led to the administration of bone marrow: its effect is very doubtful.

(*d*) **Transfusion.**—In pernicious anemia and leukemia transfusion has repeatedly been tried with no other result than a temporary improvement, which lasts until the erythrocytes introduced are destroyed.

(*e*) **Oxygen Inhalation.**—The inhalation of oxygen gives subjective relief in leukemia without giving any lasting results.

(*f*) **Extirpation of Spleen and Lymph Glands.**—The surgical treatment cannot do much. The spleen is the primary seat of the disease only in Morbus Banti, and its extirpation is there indicated. When tried in pseudoleukemia and leukemia, it has never given success. Extirpation of glandular tumors would better be substituted by the parenchymatous injection of arsenic, which leads to rapid decrease in size of the glands.

(*g*) **X-rays.**—The use of the X-rays in diseases where bone marrow and spleen and lymph glands are involved leads to a marked decrease in the volume of spleen and lymph glands, the general condition is improved, and the blood findings may become normal; however, the lasting value of this treatment, *quo ad sanationem*, is not yet definitely decided.

LEUKOCYTOSIS

Leukocytosis under Normal Conditions.—An absolute increase of leukocytes is called leukocytosis. This is a very frequent and usually only a transient symptom, which sometimes is of high diagnostic and prognostic value. The adult on empty stomach has 5000 to 6000 leukocytes in the cubic millimeter. An increase above

10,000 must be regarded as leukocytosis. An upper limit of leukocytosis, to distinguish it from leukemia, cannot be given, the morphology of the leukocytes being the decisive factor.

Leukocytosis of Digestion.—After a meal rich in proteins a moderate leukocytosis occurs, the number of cells being increased sometimes 30 per cent. of their number before eating. Some authors believe that periodical variations in the leukocyte count during the day exist independently of the phase of digestion, for the digestive leukocytosis often fails without any apparent cause. It is much oftener absent in gastric carcinoma than in benign stenosis of the pylorus and ulcer of the stomach, but this absence has no pathognomonic value. In young children the leukocytosis of digestion may show double the number at other times.

Leukocytosis in Infancy.—The normal excess of lymphocytes in the blood of infants, up to 60 per cent., as compared with 30 to 33 per cent. in adults, may disappear during a leukocytosis owing to the exclusive increase of the polynuclear neutrophiles. But also in infants a lymphocytosis, that is, an excessive increase of the mononuclear leukocytes, may be observed.

Leukocytosis of the New-born and in Pregnant Women.—The new born as well as women in labor show a moderate leukocytosis. Rieder states that the latter is chiefly found in primiparæ, more seldom in multiparæ; that it develops in the last months of pregnancy and disappears again in the puerperium.

Leukocytosis following Muscular Exertion.—After hard muscular exertion an increase in the number of leukocytes is found. This, however, may be only apparent, developing in this way, that the leukocytes adherent to the vessel walls are taken up by the rapid blood stream. Changes in the external temperature, too, may lead to leukocytosis.

Pathological Leukocytosis.—In the majority of acute diseases a more or less pronounced leukocytosis often develops, as well as in chronic diseases leading to cachexia. Further, after severe hemorrhages, in the death agony, and, above all, in inflammatory diseases of any kind, in sapremia, and after the introduction of certain blood poisons, as potassium chlorate, or a long chloroform anesthesia. The explanation of this condition is not entirely clear. Most authors believe in the chemotactic action of certain substances; Stricker and Paul Grawitz, however, believe in the autochthonous formation of leukocytes from the fixed cells of the tissue in the inflammatory focus.

Forms of Leukocytosis.—We distinguish morphologically:

1. *Polynuclear Leukocytosis.*—This is the most frequent form; and here the highest absolute figures are reached. At the same time the eosinophiles are greatly increased (Ehrlich). If they amount

to 1 per cent. or more, it speaks against a suppurative process; their behavior is similar in malignant tumors and in highly febrile infectious diseases, as croupous pneumonia.

2. *Lymphocytosis* is observed especially in childhood, in severe rickets, in sarcomatosis of the skin, and following a tuberculin injection.

3. *Eosinophilia* is found chiefly in bronchial asthma, whereby numerous eosinophile cells may also be found in the sputum; further, in pulmonary emphysema, in starvation, in malaria during an attack, in liver affections, nephritis, functional neuroses, in some skin affections, in ankylostomiasis, trichinosis, and in infection with tenia, ascaris, and echinococcus. Relatively high figures are without pathological significance in children up to the time of puberty.

Value of Leukocytosis for the Course of the Disease.—Whether we are partisans of Metchnikoff's phagocytic theory or whether we see in the alexins of Buchner the means of defense of the organism, the appearance of leukocytosis will be a proof that the organism reacts against the disease. The absence of leukocytosis is, therefore, an unfavorable symptom in croupous pneumonia (Kikodse).

Croupous Pneumonia.—In this disease the increase in leukocytes and the rise of temperature go parallel. The leukocytosis sinks before crisis. If this drop is not lasting, the decrease of temperature cannot be considered the crisis (pseudocrisis). There is usually a neutrophile, polynuclear leukocyte count between 15,000 and 75,000—the lower figures being found in the light forms, but, at the same time, in the most severe cases also. The eosinophiles disappear from the blood to reappear again before the crisis. In this way it may be possible in some cases, but not in all, to distinguish crisis and pseudocrisis. If the leukocytosis persists after crisis, a sequela must be suspected. If an exudate exists at the same time, it points to its purulent nature.

Inflammations of Serous Membranes.—Leukocytosis in the presence of a purulent, seropurulent or serous exudate is generally directly proportional to the richness of the exudate in cells A pronounced leukocytosis in meningitis points to the diagnosis of a purulent and not of a tubercular form.

Perityphlitis.—Of great importance is the leukocyte count for the diagnosis of an abscess in the course of perityphlitis. A leukocytosis of 20,000 to 25,000, according to Curschmann's opinion, demands surgical intervention; according to French, pus will surely be found if more than 35,000 leukocytes are counted. In encapsulated and very chronic processes the leukocytosis may be absent. It is, in general, lower in lighter diseases than in severe ones, but just in the most severe cases the number of leukocytes falls shortly after having attained a maximum. Of interest is the observation that para-

nephritic abscess is associated with a much lower degree of leukocytosis than paratyphlitic abscess. There exists no connection between the leukocytosis and the nature of the infective agent. If operation is performed in a case with severe peritoneal symptoms and a low or completely absent leukocytosis, the prognosis is almost always unfavorable, whereas the chances are brighter if one operates while the leukocytosis is still high. One will do well, in general, to base the indication for operation not only on the leukocyte count, but, chiefly, on a careful study of the pulse. After operation the number of leukocytes falls if there is no retention of pus, but a slight degree of operative leukocytosis may persist (up to 12,000). In regard to leukocytosis in pelvic diseases, Bérard and Descos advise performing laparotomy only if the leukocytosis is not higher than 10,000. Otherwise they consider the pus too virulent and recommend the opening of the abscess through the vagina.

Septicemia and Pyemia.—All septic diseases, whether leading to exudations or not, may be associated with leukocytosis. On the other hand, even in pus formation, leukocytosis may occasionally be absent, as in very virulent infections. On lower counts, the prognosis is more unfavorable than on high ones.

Rheumatic Polyarthritis and Endocarditis.—In polyarthritis rheumatica a slight leukocytosis is usually met with; higher figures may be expected if a purulent process in an articulation, or involvement of the serous membranes, complicates the picture. Affection of the endocardium is of no influence on the leukocytosis.

Scarlatina.—Counts of 20,000 to 30,000 are found very frequently in scarlet fever, though in uncomplicated cases leukocytosis may be absent. Eosinophilia up to 15 per cent. is a frequent finding, and its absence indicates a severe course. In doubtful cases the eosinophilia may be used for the diagnosis of scarlet fever if intestinal parasites do not give another explanation for its presence. Severe angina, abscess of the lymph glands, and inflammation of the joints may further increase the leukocytosis.

Small-pox.—In small-pox there generally exists a severe leukocytosis, especially before suppuration appears. Large mononuclears may be present up to 50 per cent. A polynuclear leukocytosis, or one appearing in the second week or later, points to a complication (abscess, pneumonia, etc.).

Chicken-pox.—In chicken-pox only on the day of eruption a slight leukocytosis may be observed.

Measles.—In doubtful cases the absence of leukocytosis speaks for measles and against scarlet fever. In uncomplicated cases of measles a certain degree of leukopenia is a fairly regular finding, preceded, in the state of incubation, by a slight leukocytosis.

Typhoid Fever.—The leukopenia in typhoid fever is much more marked. Even in the first week the number of leukocytes sinks, reaching in the second or third week 4000, or even 2000. In some cases leukopenia is an early symptom, pointing to the right diagnosis before the tumor of the spleen, the roseolæ, or Widal's reaction have appeared. According to the intensity of the other manifestations, this symptom is more or less pronounced. A rise in the leukocyte count, if complications can be excluded, is a favorable symptom. At the same time there is a relative lymphocytosis; this is of differential diagnostic value especially in children, where the diagnosis of typhoid fever may be rather hard to make clinically. On mixed infection or intestinal hemorrhage a leukocytosis develops, provided the hematopoietic organs are not too much injured. If they are injured, even suppuration may show no leukocytosis. In paratyphoid there will be the same blood findings.

Exanthematic Typhoid; Recurrent Fever; Malta Fever; Malaria.—Malta fever shows a leukopenia, whereas in exanthematic typhoid and during an attack of relapsing fever, leukocytosis is usually to be observed. In regard to malaria, opinions differ. Some report a leukopenia, others a leukocytosis during the attacks. The chronic and pernicious forms show a more or less pronouuced leukocytosis. Eosinophilia is a frequent, but not a constant finding.

Erysipelas.—A slight degree of leukocytosis is usually present in erysipelas. A considerable rise will arouse the suspicion of abscess formation. In doubtful cases an increase of leukocytes will speak for erysipelas and against erythema.

Gynecological Ailments.—If a tumor can be palpated in the female genital organs, a leukocytosis of about 20,000 speaks for a pus sac, thus for a pyosalpinx and against tubal pregnancy, serous exudations, or solid tumors.

Acute Osteomyelitis.—In osteomyelitic foci myelocytes and eosinophile cells are usually found in the blood beside the usual leukocytosis if the process is acute or if a chronic putrefaction has again become active.

Artificial Leukocytosis.—The conception that the leukocytes lead in the fight against injurious noxæ induced Loewy and Richter to produce leukocytosis artificially in animals, in order to heal infectious diseases. The results have not been uniform. v. Jaksch recommended the production of artificial leukocytosis in pneumonia with unfavorable prognosis caused by the absence of leukocytosis by means of pilocarpin, nuclein, and other substances of chemotactic action. Some authors praise the action of pilocarpin, but its use has been given up. In recent times even its theoretical foundation has become doubtful (Maragliano, Grawitz).

Leukocytosis in Anemia.—In severe anemias, as in the progressive pernicious form, the number of white blood-corpuscles is reduced approximately in the same ratio as the red ones. For the whole hematopoiesis is completely insufficient. If, now, an improvement sets in, the beginning regeneration is announced, first, by the increase of leukocytes, chiefly of eosinophiles; then follow the other kinds of leukocytes and the nucleated red blood-cells. This suddenly appearing leukocytosis, signifying a change for the better in the course of severe blood diseases, has been called "blood crisis" by v. Noorden.

Leukocytosis in Malignant Tumors.—In carcinoma, neutrophile leukocytosis with esinophilia and anemia is to be found, but only in very pronounced cases. It speaks for carcinoma and against sarcoma. If a severe leukocytosis, myelocytes, and other atypical leukocytes, megaloblasts, and a severe anemia are found in a case of malignant neoplasm, we may diagnose extensive metastases in the bone marrow.

HEMOLYSIS

By the action of various poisons, the protoplasma of the red blood-corpuscles may be injured in such a way that the hemoglobin diffuses into the surrounding fluid, whereas the stroma remains preserved. The well-known fact that the sera of many animals are able to dissolve the erythrocytes of other species may only be mentioned. It is chiefly due to Landois that blood transfusions have on the ground of this consideration been discarded from therapy. Hemolysis renders the serum ruby-red; a test, which, on examination of patients with paroxysmal hemoglobinuria, has shown that in this condition a primary hemoglobinemia through hemolysis is constantly to be found. The examination of a fresh drop of blood during an attack constantly shows, beside poikilocytosis, blood shadows. If 1/60 of the total hemoglobin is dissolved in the plasma, hemoglobinuria develops and the liver and spleen swell, blood coloring matter being deposited in them. As causes of hemoglobinemia may be named: blood poisons, morchella, biliary acids, arseniuretted hydrogen, etc., burns and freezing in individuals predisposed to hemoglobinemia.

The disposition may be caused by acquired or congenital syphilis, malaria, or states of inanition. Severe cases of typhoid fever and scarlatina, too, may lead to hemolysis, as well as tropical malaria (fièvre bileuse hémoglobinurique). Ralfé reported a unique case where cyclic albuminuria alternated with paroxysmal hemoglobinuria. We wish still to mention here the view-point taken by Hayem that primary hemoglobinuria may exist without hemoglobinemia. Michaelis observed hemoglobinuria following an abundant blood

extravasation into the peritoneal cavity, due to an extrauterine pregnancy. According to the opinion of the author, for the resorption of the blood an autolysin had been formed, but the antiautolysin formation was insufficient, so that the patient's own blood-corpuscles had been dissolved. In rare cases hemoglobinuria has been observed during pregnancy.

CRYOSCOPY

The cryoscopy of the blood may indicate an increase in its molecular concentration from renal insufficiency. A too low freezing-point, therefore, is not only a contraindication for extirpation of a diseased kidney, but points also to impending failure of renal activity. The normal difference is 0.56°; with 0.60° the renal insufficiency is pronounced and surgical intervention is contraindicated (Kümmel).

CHAPTER XV

DROPSY

General Remarks.—By dropsy we understand the effusion of serous liquid into the lymph spaces of the skin and subcutaneous tissues as well as into the serous cavities of the body. In the first case we speak of edema or anasarca, in the latter of ascites, hydrothorax, and hydropericardium.

Stasis in the veins and changes in the walls of the vessels, rendering them permeable for the serum, have to be considered the chief pathogenic factors in edema.

Stasis in the vascular system or in some part of it may be produced by a weakening of the cardiac force or by a decreased excretion through the kidneys; in the latter case only if excretion through skin or intestines does not act vicariously.

Partial stasis occurs when certain parts of the venous system are obstructed by thrombosis, pressure from without, etc. If the disturbance of circulation lasts a certain time, it exerts an injurious influence on the vascular walls, rendering them permeable.

According to the predominance of one or the other factor in the pathogenesis, the edema will be of various locations in different conditions. Thus in cardiac affections, in which the insufficient cardiac force has to be considered as the cause of the stasis, it will be called forth first in the dependent portions of the body, and edema will appear over the malleoli earlier than in other parts of the body. In renal affections, on the other hand, where, from the hindered water excretion through the kidneys the congestion is a general one, the vessel walls become diseased *in toto*, thus permitting extravasation of liquid; this diseased condition of the vessels may be due to the retention of certain substances in the vascular system which are normally excreted, at least to some extent, or to the toxic products of certain pathogenic bacteria.

The accumulation of fluid will be more pronounced in those places where the subcutaneous tissue is areolar, and formed in a way to render possible the retention of large quantities of liquid, as in the eyelids. The edema in nephritis will therefore be first observed in these places.

Theories of the Pathogenesis of Dropsy in Nephritis.—The pathologist of earlier centuries placed all the diseases associated with this threatening symptom under the name of "dropsy." Since Bright separated the well-characterized diseases of the kidney from this collective conception, investigators have striven assiduously to

explain the appearance of edema by the pathological physiology of the kidneys. Bright himself explained the connection in this way, that the excretion of the albumin led to impoverishment of the blood in proteins, and thereby to a relative increase of the water content, rendering transudation easier. The rapid occurrence of edema before great losses of albumin could have occurred cannot be reconciled with this conception. Closely related to this explanation is that of Grainger Stewart, who also sees the immediate cause of edema in the hydremia, but who does not ascribe the latter to the loss of albumin, but to a "nonelimination of water." Senator, conceding the presence of hydremia in renal affections, repudiates, however, any causal connection between it and the dropsy for the reason that hydremia does not exist before the occurrence of the edema. He believes that under the influence of the injurious action of a poison circulating in the blood, the capillaries of the glomeruli are first affected, and later the other vascular regions without the kidney, if the injurious force has lasted for a sufficient time and has been of sufficient intensity. The oliguria, according to Cohnheim and Senator, is a secondary condition, the water diffusing through the permeable capillary wall in all directions, and therefore being excreted by the kidneys in smaller quantities.

In opposition to this view, Bartels considers the cause of dropsy to be a primary insufficiency of the excretory function of the kidney for water. Thus a hydremic plethora is first produced, which then leads to dropsy. The objection of Cohnheim, that the organism may rid itself of the excess of water by the compensatory activity of skin and lungs, is refuted by Kövesi and Roth-Schulz in the following statements. The vicarious function of skin and lungs in regard to the excretion of water is rendered very difficult in Bright's disease, for the osmotic pressure of the blood, increased in renal affections, augments the insensible perspiration and the thirst.

Edema may exist, too, on abundant diuresis, which under this circumstance is only to be explained by a disturbance of the insensible perspiration. The water excretion of the kidneys is, in fact, very much lowered, the kidneys having lost the faculty of excreting a diluted, even though abundant supply of liquids. The faculty of the kidney to excrete substances in solution is considerably lessened, a condition which is followed by a diminished concentration of the urine; on the other hand, the water excretion may be lowered, and thus the diluting power is injured. In this way may be explained the accumulation in the blood of dissolved urinary substances, its increased osmotic pressure with the consequences above described—the oliguria, the hydremic plethora, and the increased capillary pressure. This causes an increased transudation of tissue fluid which cannot more be resorbed.

An increased permeability of the vessel walls, whether from toxins or retention of urinary substances may play a secondary rôle, but is certainly not the only pathogenic factor, as Cohnheim believed; otherwise the appearance of edema, but never its disappearance, could be explained. The vessel wall, having become normal, would not permit the return of the effused liquid.

In Engorged Kidney.—Concerning the explanation of dropsy in engorged kidney, the excretion of soluble matters is usually intact, and the danger of autointoxication, uremia, is not to be dreaded.

Hydremic plethora usually develops in engorged kidney, though the blood findings show polycythemia and a high hemoglobin content. These changes in the blood picture, according to Cohnheim and Zuntz, are constantly associated with congestion. Nevertheless, the water content of the blood serum is increased. The decreased rapidity of the flow, is, however, a new factor in engorged kidney, and thus the localization of the edema is also dependent on the circulation.

Cardiac force and renal insufficiency interact in the various forms of nephritis and are the determining factors in the water balance. In acute nephritis and to a certain degree in the chronic parenchymatous form the cardiac compensation cannot keep pace with the renal insufficiency. Sometimes, however, its favorable effect appears later (transformation into secondary granular kidney); in other cases it exists from the beginning for many years, until finally it gives way (tubercular kidney, gouty kidney, genuine granular kidney).

In Obstruction of the Portal Vein.—Congestive hyperemia of the intestinal serosa develops from a hindered portal circulation. Only when the congestion is of considerable degree does an accumulation of serous liquid occur in the abdomen; for in the beginning the parietal peritoneum and the lymph channels of the diaphragm, independent of the portal circulation, may again absorb the transudation. Later on, by compression of the inferior vena cava, edema of the lower extremities and finally congestive kidney and general hydrops may develop. These sequelæ may, too, be produced merely mechanically by compressing tumors in the abdomen or by peritoneal effusions.

In Anemia.—In acute anemia edema occurs rarely; it is more frequent in the chronic anemias and almost constant in progressive pernicious anemia. It is usually of slight degree, and not dependent on the position of the body, a property which distinguishes it from the congestive edema. Its favorite seat is the lower eyelids and the skin of the lower limb. Lazarus explains it, according to Cohnheim's theory, by changes in the vessel walls; Grawitz, by the hydremia of the blood.

In Leukemia.—In chronic lymphatic leukemia, circumscribed edema develops in different places of the body by the pressure

of the lymphomata on the veins and lymph vessels. On careful examination they may be recognized as local, though multiple, manifestations.

In Chlorosis.—In chlorosis edema is not as frequent, according to v. Noorden, as in other blood diseases. It is found in about 12 per cent. of cases, appearing usually in the day, and disappearing by night. In the greater number of cases it cannot be recognized after several days of rest in bed. The swelling of the ambulant patients is usually localized on the malleoli, whereas swelling of the eyelids may be found during rest in bed, also in patients not confined to bed, early in the morning.

In Malignant Tumors and Cachectic Conditions.—In malignant tumors with severe cachexia, in marasmus and in scurvy, hydrops is not infrequent, due to the lowered cardiac force, on the one hand, and to the diseased condition of the blood, on the other. Also in the course of severe phthisis it occurs sometimes, due to the marasmus, secondary nephritis, or amyloid degeneration of the kidney.

Acute Angioneurotic Edema.—Important, further, is the knowledge of acute angioneurotic edema, which is very transient and of little significance. It may involve even the mucous membranes, but has a special predilection for the eyelids (in nervous and hysterical patients, those suffering from Graves' disease, etc.).

Edema in Nervous Diseases.—In hysterical patients, local cyanosis is sometimes associated with edema (œdème bleu des hystériques). It is found in Raynaud's disease, in erythromelagia, in angioneuroses, and similar conditions. Edema frequently occurs in paralyzed members, whatever the cause of the paralysis. Its pathogenesis is probably the disturbed circulation due to the absence of muscular action or to a vasomotor paresis. A congestive edema of the eyelids may be observed following thrombosis of the cavernous sinus and the ophthalmic veins.

Collateral Edema.—Of special interest is collateral edema, developing often in the region of suppurating foci. It is purely local, generally very sensitive to pressure, and of great value for the diagnosis of deep-seated, purulent processes. Thus on the thorax it may point to the presence of empyema, in the lumbar region to a paratyphlitic or paranephritic abscess. Of special importance is collateral edema in comatose patients, since the tenderness on pressure otherwise found in purulent processes is absent and the collateral edema is often very valuable in pointing out the seat and nature of the affection.

Inflammatory Edema.—Inflammatory edema is often met with in trichiniasis—polymyositis, and polyneuritis. The first-mentioned condition shows swelling of the face and a slight degree of albuminuria.

It sets in with gastrointestinal disorders and violent muscular pain. If the invasion with trichina into the musculature is not very abundant the edema of the face may be the only striking symptom of the trichinosis. In other cases, which may be very severe, the facial edema is very fugitive and in some completely absent. In polymyositis with involvement of the skin—dermatomyositis—very abundant edema may be met with, especially over large masses of muscles, sometimes also in the face. Beside the tormenting pain in the muscles, the edema itself contributes to the mechanical hindrance of movement. In urticaria, serum exanthems, elephantiasis, exudative and nodose erythema; further, in scarlatina and diphtheria and after certain medicaments (potassium iodid), edema may be observed. Sometimes it may cause confusion with nephritic edema, but chemical and microscopical examination of the urine will enable us to clear up the diagnosis.

Diagnosis of Dropsy.—Cutaneous edema may be best demonstrated on the anterior surface of the tibia and over the sacrum. In portions of the skin which have no osseous undersupport it is often difficult to be recognized by pressure with the finger; proof of edema on the inner side of the thigh is often very difficult. The edematous portions of the skin are usually pale, more rarely cyanotic. Collateral edema, on the other hand, is red and usually shiny. Vesicles may develop over the edematous portion, which, rupturing spontaneously, may lead to oozing of the edematous fluid. If edema has developed very rapidly striæ may remain after its disappearance.

Ascites.—Accumulation of liquid in the abdominal cavity—ascites—leads to a rather uniform distention of the abdomen; in severe cases, with a flattening out or protrusion of the lumbar region. The umbilicus may also protrude. The presence of undulation, the change of sound on changed position, and the boundary of dulness concave toward the epigastrium support the diagnosis. The diagnosis is very difficult sometimes as exudate may produce similar symptoms. Acute purulent, but also chronic tubercular exudates may be freely movable (Sahli). On the other hand, on a long-existing ascites, the free mobility of the liquid may be hindered by adhesions. Ovarian cysts, too, have frequently given rise to false diagnoses. With severe ascites, symptoms of portal stasis are frequently found. Whether the portal stasis is the primary condition leading to the development of the ascites or whether it has developed secondarily as a sequela to the general congestion must be decided by the previous history of the disease and by the relation of the ascites to other eventual manifestations of dropsy. The further differential diagnosis of ascites will be taken up in the chapter on Peritonitis.

Hydrothorax.—In an accumulation of liquid in the pleural cavity

—hydrothorax—one usually finds at onset a dulness whose upper margin descends anteriorly. The liquid is, as a rule, freely displaceable. Hydrothorax usually occurs on both sides and at the same level. However, in patients who lie constantly on one side the lower half of the thorax may be more, or exclusively, filled with liquid. A unilateral hydrothorax is sometimes observed from apparently unknown causes. It is perhaps to be explained by the fact that the patients unconsciously assume a certain position at night. Pleurisy may cause great difficulty in the differential diagnosis.

Hydropericardium.—Accumulation of fluid in the pericardium—hydropericardium—is found only in extensive general dropsy. Here, too, the differential diagnosis between hydropericardium and serous pericarditis will not always be easy. The decision as to the quality of the fluid present in a cavity of the body may sometimes be reached by exploratory puncture. Only in pericardial effusions, Sahli believes, it is not indicated. Runeberg thinks that the amount of albumin found on the exploratory puncture may help in the differential diagnosis. In inflammatory, carcinomatous, and tubercular exudates he finds from 4 to 6 per cent. albumin; in congestive transudations, 1 to 3 per cent.; in hydremic transudates, scarcely ever above 0.5 per cent. The frequency of mixed forms, especially in effusions of long standing, lessens the trustworthiness of this method. Exact quantitative determinations of albumin are, too, rather complicated. It is, therefore, better to make use of the specific gravity, which, according to Reuss, stands in a certain relationship to the albumin content.

A specific gravity of:	Corresponds to an albumin content of:
1018	above 4 per cent.
1015	below 2.5 per cent.
1012	1.5–2 " "
1010	1–1.5 " "
1008.5	0.5–1 " "

A specific gravity up to 1012 will point to a transudative character of the effusion; one of above 1018, to an exudative character.

The maximum of the protein content in ascites due to stasis of the portal vein has been found to be 2.6 per cent., but in most cases below 2 per cent. if inflammatory manifestations were completely absent.

In chronic exudative and tubercular peritonitis the minimum lies at 3 per cent. These determinations, therefore, are certainly of diagnostic value. Only in carcinomatous peritonitis the variations are so great that the albumin content is not characteristic. The presence of nucleoalbumin as well as of numerous leukocytes in

the centrifugated sediment points against a diagnosis of transudation from passive congestion.

Diagnosis of the Primary Disease.—*Stasis and Nephritis.*—Hydrops due to congestion, in opposition to hydrops in the course of a nephritis, is characterized by the scanty dark urine which is of high specific gravity and rich in urates, containing almost exclusively hyaline casts and a small amount of albumin, unless a hemorrhagic infarct has developed in the kidneys. It is usually possible to cause the albumin to disappear from the urine through a digitalis treatment, which is, of course, not possible in nephritis. Only in the last stages of chronic interstitial nephritis is the differential diagnosis of cardiac affections (mitral lesions, myodegeneration) sometimes difficult, especially if the diuresis is not as abundant as we expect it in granular kidney, though at the same time hydrops exists. These terminal edemas in the course of contracted kidney are often due to obstruction. The hard pulse, the accentuation of the second pulmonic sound, and other symptoms of contracted kidney, as the low specific gravity of the urine, the albuminuric retinitis, and uremic symptoms permit the diagnosis of interstitial nephritis.

The pulse in severe cardiac affections is almost constantly arrhythmic, whereas it remains entirely regular for a long time in chronic contracted kidney (v. Neusser). Very difficult may be the diagnosis of dropsy, due to amyloid degeneration of the kidney.

The excretion of albumin may be very slight or even completely absent, as a case reported by Leube proves. There is often no sediment. The etiology and the varying specific gravity of the urine, the amount of protein, usually 1 to 2 per cent., the preponderance of globulin, and the absence of morphological elements will be valuable points. In severe ulcerative phthisis, in chronic suppuration of the bones, and in severe syphilis, the quality of liver and spleen, the presence of diarrhea, and manifestations on the part of the kidney will draw the attention of the examiner to the possibility of an amyloid degeneration. Otherwise the edema might be ascribed to the coexisting anemia and cachexia and an error in diagnosis result, which would be very important for prognosis.

Regarding the intensity of hydrops in the various renal affections: in the nephritis of scarlet fever, malaria, and pregnancy, and following exposure to severe cold it is usually very intense; in many other infectious forms of nephritis it may only be slightly marked or entirely absent. Senator considers the involvement of the glomeruli, typical, of the scarlet fever nephritis, as the etiologic factor in the production of edema. Therefore in chronic parenchymatous nephritis, abundant edema of the lower extremities and scrotum are found, as well as dropsy of the cavities. The dropsical conditions in secondary contracted

kidney are slighter, whereas in genuine granular kidney and in the congestive kidney, dependent on the cardiac condition, they behave like cardiac edema.

The absence of symptoms of a severe nephritis or of a severe cardiac lesion and the succession of the development of dropsy, first in the abdomen and then in the lower extremities, will lead to the right diagnosis, which occasionally will be substantiated by the presence of jaundice and the demonstration of biliary pigments or abundant urobilin in the urine.

Prognosis of Dropsy.—Hydrops, if extensive, may of itself endanger life by mechanically hindering the function of the heart and lungs.

Ascites does not permit a sufficient action of the diaphragm on inspiration, it presses on the large vessels of the abdomen and on the chyle ducts. Hydrothorax diminishes the inspiratory inflation of the lungs, hydropericardium the diastolic dilatation of the heart.

Dropsy is a very grave symptom, for the reason that the primary condition is commonly a severe heart or renal affection or a severe change in the composition of the blood and the vascular walls. There exist other localizations of edema which endanger life immediately, as the edema of the cerebral cortex and of the meninges or of the glottis. However, edema may be of a harmless nature. It occurs physiologically in the lower extremities after long marches, and then may be caused to disappear rapidly by a cold foot-bath and horizontal position. In people whose profession necessitates continual standing, in women who have borne children frequently—in short, as an expression of a local circulatory disturbance in the lower extremities, edema may be found every evening. Varicose veins usually point to the tendency toward this condition. Also in malaria edema of the lower extremities may be found, which is not of nephritic origin and permits a favorable prognosis. The influence of therapeutical measures in the treatment of dropsy may be controlled, as a rule, by measuring the amount of liquid ingested and excreted, as long as inspection, palpation, percussion, and auscultation do not give sufficient evidence. Edema of the back of the hand is an eminently threatening symptom in cardiac dropsy.

Of greatest importance for the prognosis, as well as for gaining information about the effect of a procedure or medication, are frequent exact determinations of the body weight. An increase of weight precedes the clinical evidence of edema, since the retention of water at first leads only to an increased water-content of the tissues. The beginning convalescence is announced by a sinking of the weight-curve, and in this way may the effect of therapeutical procedures be controlled.

Treatment of Nephrogenous Dropsy.—The treatment of dropsy

must first aim at the primary disease, but at the same time should alleviate the symptom, as this of itself may condition further injurious changes and even danger. Of chief importance is the treatment of renal insufficiency.

Theory of the Treatment of Renal Insufficiency.—A. F. Hoffmann emphasized first the "sparing" (Schonung) therapy for nephritis, and Senator, following this conception, advocated a diet poor in proteids. In acute nephritis 30 to 40 gm. proteins should be given *pro die*, in chronic nephritis 50 to 70 gm. Equivalent to the latter is 250 to 350 gm. lean meat or 1 1/2 to 2 liters milk. With the restriction of protein feeding we must not go too far, since the protein equilibrium of the organism already suffers from the albuminuria. The opinions as to the harmful effect of proteins are divided. Prior, in a case of postscarlatinal acute nephritis, observed an injurious effect from a protein supply, but not in contracted kidney. The kidneys are able to adapt themselves to increasing quantities of proteids, and albuminuria has been found to be independent of meat diet. Nevertheless, the value of a vegetable diet cannot be denied, as it prevents autointoxication to a certain degree. In compensated contracted kidney meat, in moderate quantities, may be permitted. It is quite different in nephritic patients with a tendency to edema. Considering the dangers produced by retention of metabolic products, we will regulate the diet in order to avoid an increase of the osmotic pressure of the blood with its injurious consequences; otherwise, as previously mentioned, the insensible perspiration and the thirst increase more than the diuresis. Even if no hydrops is present the NaCl supply will have to be restricted, if there is a retention of NaCl. For the latter certainly acts injuriously, though no connection between it and uremia is to be supposed. (Widal). Too small an amount of salt in the food may lead to a decreased water excretion, as a diseased kidney usually loses the faculty of diluting in a marked degree, and, on the other hand, too small a supply of liquid may lead to the retention of soluble substances since the faculty of condensation suffers.

Liebermeister and Ziemssen, believing that the skin may act vicariously for the kidneys, recommended treatment by sweating. Leube, on the other hand, warns us against its use if uremia is threatening, and believes that a uremic attack may even be brought on by it; he advises in such cases to decrease the danger arising from a concentration of the toxins by an abundant supply of liquid. Kovesi and Roth-Schultz, however, deny the existence of this danger, for, if in the course of a sweating procedure a patient loses 1/2 kg. in weight, and, on the other hand, he excretes from 1 to 2 gm. N and as much NaCl, the kidney secretion being unchanged, the concentration of the blood is therefore rather decreased, certainly not increased. In the

presence of edema the supply of liquids will be as far restricted as is permitted by the morbidly decreased faculty of the kidney to produce a concentrated urine.

Acute Nephritis.—The excretion of liquids by the intestines may be stimulated by means of laxatives. In acute nephritis absolute rest in bed must be observed. Milk, eventually diluted with an alkaline water, is the best food. Kephyr may be given a few days later. Alcoholic drinks are strictly forbidden; meat broth is inadvisable on account of its content in extractives. After the condition has improved, it is only with the greatest precaution that one may return to the usual diet.

One begins first with milk soups, floury foods, bread and butter, green vegetables; later one tries the yellow of eggs, and only after complete recovery, meat.

Of the medicinal remedies, the compound infusion of senna and citrate of magnesia will serve to stimulate the intestinal secretion. The diuretics proper, as diuretin, uropherin, caffein, do not render much aid in nephritic hydrops in removing the edema, but on the retention of soluble substances, without edema, the phosphates and N-containing substances are sometimes eliminated. In earlier times, tannic acid was considered a remedy against nephritis itself, but unfortunately this has not proved true. Diaphoresis is a remedy not to be underestimated; it is best stimulated by hot baths at a temperature of 37° to 42° of one-quarter to one-half hour duration. Forced sweating procedures at higher temperatures and of longer duration are not advisable. The patient should be wrapped in blankets after the bath, cold compresses being applied to the head during the whole procedure. Somewhat milder is dry packing. The patient is wrapped in a woolen covering, whose fine hairs stimulate the cutaneous nerves, thereby causing relaxation of the cutaneous vessels. This produces acceleration of the blood circulation in the skin and an increased sweating (Buxbaum).

Of very good effect are protracted baths in indifferent water at a temperature of 34° to 35° C. They act favorably on the diuresis, on the nitrogen, albumin, and salt secretion. Hot-air baths, too, will be found of valuable service. The electric-light bath permits of better regulation and control and is found more agreeable by the patients; the production of sweat can be observed at once, and is sometimes excessive, but is not disagreeable to the patient. Subcutaneous injections of pilocarpinum hydrochlorid, in doses of 0.01 gm., have a strong diaphoretic action. In edema of the glottis, scarification of the swollen aryepiglottic folds and epiglottis may obviate in some cases the otherwise necessary tracheotomy.

If pulmonary edema is imminent, an injection of camphor must

be given at once and cardiac tonics be prescribed. Traube advocated the use of lead acetate, 0.05 gm. every hour, a remedy which Nothnagel also used in treating this condition.

If cutaneous edema is very abundant, scarification may be performed, but under entirely aseptic conditions, as erysipelas develops very readily in nephritic patients and takes a very malignant course. Southey constructed special cannulæ for the drainage of the subcutaneous tissue. The capillary trochars of Curschmann serve the same purpose.

Ascites, hydrothorax, and hydropericardium may demand surgical intervention due to a vital indication, if respiration or cardiac action is mechanically hindered.

Puncture of the Abdominal Cavity.—Marked ascites sometimes demands puncture. Frerichs warns against puncturing too early and against repeating it too soon, as the reappearance of the effusion means a great loss of body fluid. It cannot be denied, however, that ascites itself is a severe hindrance to circulation, forming in this way a vicious circle. If puncture is performed, it is better combined with digitalis treatment. Lasting results can only be expected if the cardiac force is strengthened at the same time that the impediment to the circulation is removed (Penzoldt). This puncture and digitalis is less indicated in acute nephritis than in the severe cardiac lesions and in liver cirrhosis, and may be tried when every other mode of treatment has been found insufficient. The proper place for puncture is the middle point between umbilicus and symphysis, best in the linea alba or in the external half of Richter-Monro's line, which extends from the umbilicus to the anterior superior spine of the ileum. The patient must recline, as otherwise syncope may easily occur. Only in cases of severe dyspnea may a sitting position be permitted. After careful disinfection the sterile trochar is grasped with the full hand and pushed vertically into the skin, the operator marking with the index-finger the point on the trochar to which it shall be inserted. Hemorrhage of a serious degree sometimes occurs by injury to the epigastric artery, sometimes from the sudden relief from pressure. If compression of the abdomen and the application of cold do not suffice to arrest the hemorrhage, laparotomy will become necessary. Care must be taken to ensure a slow outflow of the fluid and to prevent the entrance of air. This is best accomplished by pushing the trochar in through a rubber shield, which acts like a valve, and by permitting the serum to flow out under water. The point of insertion is best treated by suture; if serum oozes out, a sterile cotton pledget must be pressed against the opening and the skin on both sides must be taken up into folds and fixed by adhesive plaster, as is done in the treatment of umbilical hernia (Gumprecht).

Puncture of Hydrothorax.—Serous effusions of the pleural cavity must be removed by puncture only if they become dangerous from their extent or if pulmonary edema is imminent. The removal may be made as complete as possible in healthy lungs as they are able to expand. In hydrothorax the conditions are different from pleurisy, where the lungs do not expand with the outflowing exudate so promptly. One of the well-known aspiratory apparatus, for instance, of Dieulafoy or Potain, may be used; in an urgent case, their trochar, armed with a rubber balloon, may serve the purpose. The aspiration of the liquid is performed by a syringe. As the liquid passes only very slowly through the small lumen, the removal of the transudate will demand much time (one to two hours), but for just this reason, the operation is very well borne. The patient who is to be punctured is placed in an elevated dorsal position and inclined toward the side not to be tapped. The anterior or middle axillary line in the fourth or fifth intercostal space is best chosen for operation, since any injury to the diaphragm is practically excluded here.

In hydrothorax the patient must not change his position after examination previous to puncture, as otherwise the level of the liquid changes. The puncture must on no account be made lower than the seventh intercostal space, as otherwise the diaphragm may be hurt. Careful asepsis and the correct closure of the cocks is absolutely necessary in order to avoid a pneumothorax. Syncope, palpitation, violent coughing spells, foamy sputum, pointing to beginning pulmonary edema, demand immediate interruption of the puncture. Short dry cough, on the other hand, announces expansion of the lung. It will cease on morphin injection. The appearance of albuminous expectoration is a sequela of too rapid removal of fluid.

On the first signs of a congestive hyperemia of the lungs with commencing pulmonary edema, the procedure must at once be stopped and a good dose of camphor given. The puncture of a pleural exudate in coexisting indurative mediastinopericarditis is a very risky undertaking. The other lung in this case cannot move with the mediastinum toward the punctured side, and therefore the lung on the affected side alone has to fill the vacuum, threatening the danger of pulmonary edema. In such cases only small quantities, some few hundred cubic centimeters, must be slowly removed.

Puncture of Hydropericardium.—Hydropericardium usually develops in the final stage of general dropsy. Paracentesis must be tried in desperate cases and may give relief, though only temporary, by rendering the diastole of the heart possible. The paracentesis is performed in the fifth or sixth left intercostal space, somewhat external to the mammillary line, to avoid the internal mammary artery. The elevated dorsal position is indicated to avoid any lesion of the heart,

for the same reason one will penetrate through the different layers very slowly. Aspiration must be performed with greatest care. It is advisable before the puncture to introduce a long, fine, hollow needle, if it shows no excursion it has penetrated into the myocardium. An exploratory puncture, in any case, has to precede the paracentesis.

Chronic Parenchymatous Nephritis.—All the therapeutic measures discussed above to combat hydrops are more used in chronic nephritis than in the acute form. Here may be indicated mild diuretics from which an increase of inflammation is not to be dreaded; these are alkalies, as potassium and sodium acetate, in 2 gm. doses, several times a day; liquor ammonii acetici, further, citrates and tartrates, or tea made from the species diureticæ; also caffein, diuretin, convallaria, adonis, and above all digitalis and scilla. The dosage of these remedies will be given under the Treatment of Cardiac Dropsy. If the hydrops is of slight degree it often ceases on rest in bed; if it is severe and no decrease can be accomplished by any other means, the drainage by capillary trochars may be tried; Senator removed 10 liters in twenty-four hours in one case by this method. Also Schroth's antithirst treatment (diæta sicca) may, if rationally employed, be useful, but it may produce severe harm. Of course, the treatment of the primary disease, if it is possible, should be the first aim of the treatment. The causal indication can only be fulfilled in malarial nephritis, but unfortunately even in this case the specific treatment with quinin does not always cure the nephritis.

Strict avoidance of all bodily exertion and sparing of the kidneys by stimulation of the skin and intestinal functions, and a nonirritating diet are the fundaments of the treatment.

The chief food in acute nephritis should be milk, which, while free from extractives, contains all the necessary food constituents. Beside milk, buttermilk, kumiss, and kephyr may be given, as well as compotes and light floury foods. In chronic nephritis meat may be permitted in moderate quantities beside the diet just named. Dark meat contains only little more extractives than white meat. It must not be entirely removed from the menu, but only taken in smaller portions than the white meat. Carbohydrates and fat may be permitted without hesitation; alcohol, highly seasoned sauces, radishes, and asparagus must be forbidden.

Chronic Interstitial Nephritis.—The danger of uremia is the chief concern in the management of chronic interstitial nephritis. Hydrops develops where the cardiac force gives way and has to be treated in the same way as that in uncompensated heart lesions. Sweating procedures and hot springs, much in favor in the treatment of the earlier stages of the disease, must be used with the greatest

precaution in severe cardiac hypertrophy and arteriosclerosis. A sojourn in the south will be found valuable in winter. On any exacerbation of the disease in the form of subacute relapses, such as occur in secondary contracted kidney, the measures employed in chronic parenchymatous nephritis will also be valid here.

In recent times Roosing advocated nephrolysis, which is said to act favorably by removing perinephritic adhesions and their resulting compression.

Nephritis in Children.—Acute nephritis is frequently observed in childhood in the course of acute exanthems, chiefly in scarlet fever, but also in diphtheria, malaria, pneumonia, erysipelas; even epidemic parotitis, aphthous stomatitis, and simple cutaneous affections, like impetigo, may lead to nephritis; further, gastrointestinal disorders and intoxications with drugs taken internally or placed on the skin. Extensive edema appears, as well as effusions into the serous cavities; sometimes the first symptom of hydrops may be edema of the glottis. Death may occur from pulmonary edema, secondary inflammations, and uremia, sometimes from an acute dilatation of the left ventricle. The pulse must therefore be carefully examined before any prognosis is given. It should be regular, though its tension may be increased. A lowered tension and arhythmia are of unfavorable prognosis.

The chronic parenchymatous nephritis of childhood may follow the acute form or develop in the course of phthisis, a chronic skin or intestinal affection, or malaria. Also amyloidosis may sometimes be associated with it. Recovery from chronic parenchymatous nephritis is not as infrequent in children as in older persons. Contracted kidney, the genuine as well as the secondary, in whose etiology scarlet fever, tuberculosis, syphilis, and nephrolithiasis play a great rôle, is a condition not very frequently found in children. In the treatment of the nephritis, and especially of the nephritic hydrops of children, the same measures are employed as in the identical affections in adults. In the acute disease, only milk and carbonic acid waters should be given. If there is pain in the kidney region, moist compresses in the lumbar region, changed every three hours, will be grateful to the patient.

Sweating is instituted by having the patient bathe for one-half hour once or twice a day in water at 34° C., following this with hot sugar-water internally; by means of a hot jacket afterward one may prolong the sweating for two hours; but if uremia threatens, the last procedure is better omitted, the baths alone being continued. The bath may be substituted by packings in hot wet sheets in which the children remain for one hour. The following may be used as diuretics in children:

Rp. Diuretin up to 3.0 pro die
Agurin up to 1.0 pro die
Kali aceticum, 2.0–5.0 : 100.0
Rp. Infus bacc. juniperi, 5.0 : 100.0
adde Liq. kal. acetici,
Roob juniperi, āā 10.0
One dessert spoonful every two hours.

Rp. Decoct. ononid. spinosi, 5.0 : 100.0
adde Oxymel scillæ 10.0
DS. One dessertspoonful every two hours.
Lith. carbonic., 0.3 pro die

In coexisting hematuria:

Ergotin (Bombelon), 0.5–1.0–2 : 100.0

or

Inf. secal. cornut., 0.5–1 : 100.0

or

Gelatinæ albae., 2.0 : 100.0
DS. One dessertspoonful every two hours.

In severe albuminuria:

Tannalbin, 1.5 pro die

or

Chinin tannic 1.0 pro die

In threatening heart failure:

Inf. digitalis, 0.1–0.2 : 70
One dessertspoonful every two hours.

or

Tct. strophanti one to three drops three to four times daily.

Treatment of Cardiac Dropsy.—Remarkable results are sometimes accomplished in the treatment of cardiac dropsy. The following are the diseases of the heart which may lead to congestive dropsy:

1. Mitral and tricuspid insufficiency, rarely and only in advanced stages.

2. Pericarditis. In purulent pericarditis the myocardium is usually involved. But just in this affection an extensive production of dropsy occurs only rarely, owing to its very rapid course; in serous pericarditis the mechanical hindrance to diastole plays some part; however, the important factor is not only the quantity of the effusion, but also the rapidity with which it develops. If it develops slowly, the heart gradually becomes accustomed to it (L. v. Schrötter).

3. Myocarditis, acute, *e.g.*, infectious, following scarlet fever or diphtheria; it leads sometimes to congestive pain in the liver capsule, but scarcely to edema, as is the case in chronic myocarditis. The fatty heart also may give way to hydrops through stasis.

Here belongs the hypertrophy of the right ventricle in the course of pulmonary emphysema when the cardiac force gives way.

Symptomatology of Cardiac Edema.—Cardiac edema is characterized by its blue color and coldness to touch. A high degree of cyanosis without edema is found in congenital heart lesions, which lead to hydrops only shortly before death, if at all.

The quantity of urine is considered by Jürgensen as the indicator of the cardiac force. In acute cardiac weakness quantities of 100 c.c. of urine *pro die* may be observed, and edema is usually absent just in these cases. The specific gravity of the urine is almost always increased—1035 or more—as there is no retention of dissolved substances. In some cases, however, the specific gravity may be no higher than 1020. Even if the renal activity is lessened for a long period, there is no lasting loss of functional capability, and entirely normal function is possible.

In cardiac dropsy it is advisable to have the patient observe absolute rest in bed and to control his supply of liquids. Krehl advises not to permit cardiac patients to drink more than 1 1/2 liters of liquid in one day, and if dropsy has already developed only 1 liter. But the patients should by no means be allowed to become thirsty, since prostration or, in other cases, a state of excitation will develop; thus the restriction of liquid, as advocated by Ortel, is sometimes decidedly harmful.

Medicinal Treatment.—In the medicinal treatment *digitalis* is of insurpassable value if given on the right indication. When the pulse is unequal and arrhythmic, but when a few vigorous pulse-beats indicate that the heart is not too much fatigued, one may count on the sure effects of digitalis. This indication, however, by no means excludes its use in other forms of cardiac weakness, and Penzoldt advises that a trial be given digitalis even when pronounced bradycardia exists.

If the pulse is small, regular, and very frequent, no effect can be expected from digitalis, as the heart does not possess more reserve power which can be relied on. In such cases the simultaneous administration of digitalis and camphor in powder form, of each 0.1 gm. three times a day, may be tried.

Fürbringer advises the combined administration of digitalis, tinctura strophanti, caffein, and liquor pot. acetat. One may give:

Rp. Infus. fol. digitalis, 1.0 : 80.0
Syrup. simpl., 20.0
DS. One tablespoonful every two hours.

Ortner prefers a maceration lasting six to twelve hours to the infusion of digitalis. Pills containing 0.05 gm. of the folia digitalis may be prescribed, and 2 to 3 pills may be taken daily for five days.

As contraindications for digitalis treatment we have to consider the bradycardia found in idiopathic affections of the cardiac muscle and in stenosis of the arterial or venous ostium; further, the danger of vessel rupture, produced by a rise of blood pressure in diseased condition of the vessel walls. In these cases it is advisable to give 1 to 2 mg. atropin *pro die*, beside digitalis, or to try diuretin. By this medication the edema may disappear after thirty-six hours, an abundant diuresis is produced, the painfulness of the liver decreases, the congestive catarrh improves, and an effusion within a serous cavity gradually disappears. Digitalis should only be used for three consecutive days on account of its cumulative action. After a pause of three days, it may be given anew for the same period. The active principles of digitalis—digitoxin, digitalin, and in recent times digalen—have been brought on the market; in urgent cases they may be used subcutaneously.

Tinctura strophanti, taken in doses of 5 to 10 drops three times a day, may serve as a substitute for digitalis, though not exactly its equivalent. On symptoms of severe cardiac weakness, subcutaneous injections of camphorated oil are advisable. On existing hydrops cardiac remedies alone will scarcely be sufficient, and diuretics acting directly on the renal parenchyma will have to be used.

As *diuretics* may be recommended the caffein and theobromin compounds, the sodium salicylate and sodium benzoate of caffein, prescribed in a daily dose of 1 to 1.5 gm. in 180 c.c. water, and the sodium salicylate of theobromin, which, under the more common name of diuretin, is one of the favorite diuretics. It acts on the renal epithelium, on the heart and vascular system, without injurious secondary effects, but has a bad taste, which sometimes renders its longer use difficult. In doses of 1/2 to 1 gm., a daily amount of 4 to 6 gm. may be given. For instance:

Rp.	Diuœtin,	4.0
	Aqu. destill,	150.0
	Aqu. menth. piper,	50.0

The sodium acetate of theobromin (agurin) is sometimes preferred, producing a copious diuresis in a daily dose of 3 gm. In administering it, one will do well to remember that the powder is very hygroscopic melting away in the air. It is therefore advisable to prescribe it in tablet form.

In recent times theocin (theophyllin) has been recommended, which acts much more rapidly and intensely than theobromin. It is given in doses of 0.2 to 0.3 gm. up to a daily quantity of 0.75 gm. The gastric discomfort which it sometimes causes may be avoided by using it in the form of suppositories. By these modern remedies others have been forced into the background which formerly were

much in favor, as potassium nitrate and acetate and vegetable diuretics and cardiac tonics, as convallaria, adonis, scilla, petroselinum, ononis spinosa, etc. They all have a somewhat irritating action on the kidney. The following combination may be used.

Rp.	Liquor kal. acetic.,	15.0
	Aq. petroselini,	150.0
	Oxymel scillæ,	15.0
	Syr. simpl.,	15.0

DS. One tablespoonful every two hours.

A very excellent diuretic in dropsical conditions due to cardiac insufficiency is calomel. It is absolutely contraindicated if the kidneys are affected, as it may lead to severe mercury intoxication and to an exacerbation of the inflammatory processes in the kidneys.

Jendrassik recommends 0.2 gm. calomel three times a day, which produces a diuresis for three to four days, whereupon the remedy has to be interrupted. Care for the mouth is urgently advised during its use. The mouth may be washed out with a 1 per cent. solution of potassium chlorate, and the gums may be brushed with equal parts of tincture of ratanhiæ and of myrrh. Diarrhea produced by the catarrhal irritation of the intestine is effectively combated with a little opium; but sometimes it is intractable, owing to ulceration, like that produced in sublimate poisoning.

On long-existing severe hydropsical conditions and in a weakened organism, the calomel treatment is at any rate a risk.

In dropsy due to liver cirrhosis calomel is sometimes beneficial. It is given in doses of 0.05 to 0.1 gm. four times a day. Urea often proves itself a good diuretic in an ascites caused by liver cirrhosis. Thus:

Rp.	Ureæ puræ,	30.0
	Aquæ destill,	200.0

M. D. S.—One tablespoonful every two hours.

An excellent diuretic is cream of tartar, especially useful in ascites.

The circulatory disorders in their lighter, chronic forms deserve, of course, *dietetic* and *mechanical treatment.*

We must aim to accomplish a deposition of proteid and to decrease the fat of the body, since a too large amount of fat becomes an impediment to circulation and respiration. The antifat treatment, cautiously performed, has often excellent results. The cardiac force may be strengthened by careful gymnastics and by walking up ascending roads, which accelerates the circulation and produces a better filling of the aortic system; however, only in the beginning of the compensatory disorders.

The best results will be accomplished in the fatty heart. This exercise is not advisable in coronary sclerosis, in severe arteriosclerosis,

in chronic nephritis, in recurrent endocarditis, in insufficiently compensated heart failure, in marked stenosis, or in pericardial adhesions.

The treatment of circulatory disorders by baths was instituted by J. Jacob, and further developed by the brothers Schott, in Nauheim. Carbonic-acid baths, containing brine and iron, are given at a temperature of 33° to 30° C. for ten minutes; the content of salt is gradually increased from 1 to 4 per cent. parallel with the amount of carbonic acid. These baths often tire the patients in the beginning, so that a rest for several hours after the bath is necessary; after two or three days, the bath is omitted for one day. Later on, the treatment may be combined with massage, the mechanical gymnastics of Zander or the manual gymnastics of Schott.

Sweating treatment is seldom employed in treating cardiac dropsy.

Partial washing, short rubs, or sitz-baths may have a stimulating action on the circulation. Since all these procedures place demands on the cardiac power, the tolerance of the organism should first be tested by partial washing, preferably of the lower extremities. An excellent cardiac tonic is Leiter's cooling apparatus, applied on the heart three times a day for one hour. It may also be placed on the neck.

In recent times, Brauer advocated an operation, *cardiolysis*, for concretio pericardii cum corde (adhesive pericarditis). The purpose of the intervention is not to free the adhesions, which would have only a temporary effect, but to alleviate the difficulty of the heart, which must, on the presence of adhesions, at each systole overcome the elasticity of the thorax by freeing the adherent segment of the thorax. The success is often surprising.

Dropsy in Children.—(*a*) *Scleroderma and Sclerema of the New-born.*—In regard to edema in childhood, only those conditions will be mentioned here which are especially characteristic of, or peculiar to, this age. The scleroderma of the new-born attacks usually only children in the first year of life; coolness and edema become manifest on feet and thighs, followed at times by induration of the cellular tissues, which hinders the mobility of the limbs. This condition extends gradually over the whole body, and with continual dropping of the body temperature results in death in a few days. The true nature of this disturbance, affecting cardiac activity and the production of heat, to which prematurely born, debilitated, and poorly nourished children are predisposed, is still disputed. Also the nosologic relation to fat sclerema is not entirely clear.

The treatment consists in appropriate feeding (breast), and in the artificial increase of heat (incubator, warm baths), in passive movements of the stiff limbs, massage, and the stimulation to crying.

(*b*) *Idiopathic Edema of Infants.*—Ludwig F. Meyer believes that there exists an edema in infancy without cachexia or disturbance of the cardiac or renal function, which is due solely to the insufficient faculty of the urinary epithelium to excrete mineral salts.

The treatment consists in the administration of nourishment, as poor as possible in salt, the best being human milk.

(*c*) *Erysipelas.*—It is important to know that erysipelas in debilitated children with cardiac weakness often impresses us at first glance as a simple edema.

(*d*) *Cardiac and Renal Diseases of the New-born.*—The morbid conditions leading in adults and older children to hydrops are only rarely associated with edema and effusions in the new-born. When this is the case the picture often resembles the sclerema edematosum just mentioned. Cases of nephritis and myocarditis have been reported, which existed already at the time of birth (Henoch). The presence of dropsical conditions is uncommon in congenital heart lesions. In tetany, especially in cases with persistent contractures, an edema on the dorsum of the foot may sometimes be found. The treatment of uncompensated heart lesions in children is identical with that of adults. One prescribes, according to Seifert, Pulvis fol. digitalis, or the infusion, for a child of one to two years up to 0.02 gm. *pro dosi*, 0.1 *pro die*. For a child of three to four years, up to 0.02 gm. *pro dosi*, 0.12 *pro die*. For a child of five to ten years, up to 0.03 gm. *pro dosi*, 0.2 *pro die*. For a child of ten to fifteen years up to 0.04 gm. *pro dosi*, 0.3 to 0.5 *pro die*. Or one drop of the tincture strophanti three times a day, but only in children older than five years. Diuretin may also be given to younger children in doses of 0.25 gm. several times a day; caffein sodium salicylate, 0.1 to 0.5 gm. to 100 water, 1 dessertspoonful every two hours.

Cirrhosis of the Liver.—The hydrops of atrophic liver cirrhosis, due to stasis of the portal vein, may sometimes be complicated by chronic peritonitis, by cardiac insufficiency, or by both conditions. One may therefore accomplish transient results with digitalis. The ascites which is due to portal stasis alone is sometimes improved considerably by copaiba balsam, by squills, by theobromin, calomel, and by cream of tartar. One will always have to combat the dyspepsia and gastrointestinal disorders at the same time. Mineral waters, the systematic use of cathartics, and an exclusively milk diet will help in the first stage of the condition. When the diagnosis is doubtful the antisyphilitic treatment should be tried. Puncture should be performed only when actually indicated. Its early use has been completely abandoned.

Talma has advocated fixation of the large omentum to the abdominal wall, producing in this way a collateral circulation from the portal

system to that of the inferior vena cava. The material is still too small to be any criterion as to the benefit of Talma's operation.

Peritonitis.—The most frequent form of peritonitis leading to ascites and eventually to general dropsy is the tubercular peritonitis.

The treatment consists in daily inunctions of green soap. The ascites sometimes recedes rapidly under this treatment. Laparotomy has, at present, less enthusiastic partisans than a few years ago, for examination of permanent results shows that operation scarcely surpasses the hygienic dietetic treatment.

Relatively rare is the nontubercular, chronic, exudative peritonitis sometimes developing after trauma or in the course of a chronic nephritis, which, on a long-continuing ascites, leads to dropsy of the lower extremities. The prognosis is usually favorable, and the treatment consists in mud or bog fomentations or in inunctions with green soap. Puncture is reserved for cases with enormous ascites. Almost a half of all cases occur in childhood. As etiological factors, measles, chronic vulvovaginitis, and pronounced diarrhea are also to be considered. In the medicinal therapy of tubercular and simple chronic peritonitis in children, the following may be used: Ferrum iodatum saccharatum in doses of 0.01 gm. several times a day. Or the syrup ferri iodati, as many drops as the child has years, three times a day. Also ol. jecoris aselli, 1 to 2 teaspoonfuls daily. Inunctions with green soap, baths with iodin salts, puncture and laparotomy may become necessary.

Other Forms of Dropsy.—In all dropsical conditions in other diseases the treatment of the primary affection is the leading indication. In edema of several blood diseases the treatment of the blood condition will be sufficient.

Netter describes a hemorrhagic purpura with relapsing edema of the hands and feet as well as of the face, without nephritis, which disappears on the healing of the diathesis. Two other forms of edema, that of the glottis and the lungs, will, owing to their eminent importance, be discussed in detail at another place.

CHAPTER XVI

EXAMINATION OF THE URINE

A. AMOUNT AND SPECIFIC GRAVITY OF THE URINE

Anomalous changes in quantity and specific gravity of the urine are commonly associated; on scanty secretion the specific gravity increases and *vice versa.*

Polyuria is found chiefly in diabetes insipidus, diabetes mellitus and in contracted kidney, as well as in some organic and functional nervous diseases; oliguria in cardiac weakness, and in the presence of effusions, violent diarrhea, nephritis, and mechanical obstacles in the efferent urinary passages, in high fever and hysteria.

Serikowski gives the following table:

Oliguria.—1. With an excess of the solid constituents in the initial stage of every fever.

2. With normal or decreased quantity of solid matters, after obstinate diarrhea and chronic fevers, which may be explained by the decreased elimination of chlorids, especially in pneumonia.

3. With a diminution of solid matters, in anasarca dependent on nephritis or on those changes in the blood circulation in which only little urea and sodium chlorid are excreted; further, in lowered general metabolism, in severe anemia, and in the final period of acute and chronic fatal diseases.

Polyuria.—1. With an excess of solid substances (in diabetes mellitus).

2. With a decrease of solid substances (in diabetes insipidus, urina spastica of the hysterical, nervous polyuria).

B. ALBUMINURIA

Historical and General Remarks.—In the year 1770, Domenico Cotugno discovered that some urines contain an albuminous body coagulable by heat. Fifty-seven years later, Bright found a connection between the clinical picture of the group of diseases, which later on were named after him, and the occurrence of albumin in the urine. It is readily understood that albuminuria was at first thought to be a very fatal, morbid manifestation; very careful and extensive experimentation, including the latest results of proteid chemistry, were necessary to obtain a right estimation of the value of this symptom.

There are, however, still some forms of albuminuria concerning the significance of which opinions differ widely, and even to-day it often becomes difficult to decide with which group of albuminuria a given case should be classed.

True and False Albuminuria.—In the first place, we have to distinguish from true renal albuminuria the admixture of albumin-containing liquids in a urine, which was albumin free when secreted. In this case we may have to deal with sperma, prostate secretion, the discharge of an ulcerating tumor, chyle, blood, and pus. In the further course of this discussion we shall, under the term albuminuria, discuss only the true renal form.

Albuminous Substances in Albuminuria.—Albuminuria, in a broader sense of the word, may be divided according to the protein matter contained in the urine.

One finds:

1. Serum albumin.
2. Serum globulin.
3. Mucin.
4. Fibrin.
5. Urinary "peptones" or albuminoses.

True peptone, in the sense of Kühne, is not found in the urine as far as is known.

Decomposition products of albumin, termed by Kühne albuminoses, are, however, not rare in the urine and have been designated by Brücke peptones. Since in true albuminuria it is the protein bodies of the blood serum which appear in the urine, under the name albuminuria, we will understand only the presence of serum albumin and serum globulin.

Accidental Albuminuria.—We recognize a physiological albuminuria; it is only of short duration and occurs usually in the morning hours. Senator found among 100 healthy soldiers traces of albumin in the urine of forty-one. According to Dreser, we distinguish five forms of physiological albuminuria:

1. On overexertion.
2. Intermittent, cyclic, in puberty.
3. On overfeeding with heterogenous proteid.
4. From vasomotor disorders.
5. From cold baths.

The degree of albuminuria after bodily exertion may amount to 1 pro mille, according to Leube; to 4 pro mille, according to v. Noorden. Hyaline casts also are found in small numbers, but no other forms. At any rate, this albuminuria is a very transient symptom. In prize fighters every trace of albumin has disappeared after twenty-four hours.

At puberty, Lommel found albuminuria in 20 per cent. of young workmen and at the same time a slight hypertrophy of the left ventricle and increased arterial tension.

After an abundant ingestion of heterogenous proteins, albuminuria may be observed, as already mentioned. Thus, on milk diet, cow's albumin may first appear in the urine, and the irritation caused by its passage through the kidney may give rise to the common albuminous bodies in the urine. In digestive disorders protein may appear in the urine; in constipation almost exclusively serum albumin. Albumin and casts may be found in constipation. Whether this is due to an autointoxication or to mechanical pressure is undecided. That the latter may lead to albuminuria is proved by the observation of Rolleston. He observed that persons with enlarged spleens excrete albumin if they have lain for some time in a dorsal position. In this way pressure is probably exerted on the renal vein, this pressure being dependent not only on the size of the splenic tumor, but also on the position of the suspensory ligament of the spleen.

Cyclic Albuminuria; Orthostatic Albuminuria.—The cyclic albuminuria of Pavy and the orthostatic form of Heubner are two conditions found in children between the fifth year and puberty.

Occurrence.—Whereas the night urine is free from albumin, that passed in the day time, especially in the forenoon, sometimes contains very considerable quantities of albumin, up to 5 pro mille. In some cases the relation is just the opposite, the night urine containing albumin, the day urine being free from it. This type of excretion probably represents a morbid picture in itself, reminding us of the hypostatic albuminuria of splenic tumors as just described.

Explanation of Albuminuria.—The cyclic course of this albuminuria is not connected with a standing position, but, according to the opinions of Sterling and of Heubner, with the transition from the horizontal position to the vertical one. The action of muscles certainly cannot be the noxa producing albuminuria, for standing is more injurious than walking, and an aimless walking about more harmful than a strenuous march. Others see the important factor not in any position of the body, but in the digestion of food. The albumin disappears in the afternoon after luncheon, though the standing position of the body is maintained.

Its Significance.—In regard to the pathogenesis and importance of this affection, two different standpoints are taken by various clinicians. Some, as Senator, insist on a certain relationship between cyclic albuminuria and nephritis. According to this view, transitions to chronic Bright's disease are believed possible.

On the other hand, Heubner's point of view, gaining more and more partisans, is that we have to deal with a constitutional weakness

of the kidney filter, which bears no relation to nephritis. Even in cases in which such an albuminuria has followed an acute nephritis, as in scarlet fever, its termination in chronic nephritis has never been observed. This albuminuria is only the expression of an organism easily fatigued and exhausted, owing to a nervous hereditary taint (O. Jacobsohn).

We must add that occasionally a cyclic course of albuminuria is to be found in the first stage of contracted kidney; but, according to Heubner's opinion, these are not identical conditions, though apparently very similar.

An important contribution to the pathogenesis of orthostatic albuminuria has recently been presented by Jehle in Escherich's clinic. He observed that a lordotic curvature of the spine, whether constantly present as an acquired condition or produced by a certain kneeling posture, produces albuminuria in many children.

Differential Diagnosis.—The examination of the sediment will be found helpful in the differential diagnosis, since the amount of albumin itself may be very high and therefore will not permit of any conclusions. Hyaline casts may be found in small numbers, in cyclic albuminuria, but if granulated or epithelial casts appear, we certainly have to deal with a diseased condition of the kidney parenchyma.

Langstein found in the urine of orthostatic albuminuria a protein body, insoluble in an excess of acetic acid, which is closely related to the euglobulin of Hofmeister. However, this finding is, as yet, of no semiotic value. The other findings are not sufficient to clear up diagnostic doubts. The patients affected with this condition are usually pale, easily fatigued, and suffer from headache. Increased arterial tension is usually not demonstrable, but some authors found changes in the heart, consisting in systolic murmurs, heaving apex beat, tachycardia, palpitation, and arrhythmia: symptoms which Krehl comprises under the name of Cor juvenum. Slight edema over the sacrum, due to the associated chlorosis, may render the diagnosis of the condition still more difficult. In other cases the excretion of albumin found in thriving children in complete health may only be discovered accidentally.

Therapy.—In cyclic albuminuria as well as in that of puberty, which may disappear in girls after the first menstruation, no treatment is necessary. As the prognosis is entirely favorable, it would be absurd to torment the patient with the severe diet prescribed in Bright's disease or with persistent rest in bed, factors which would impair the proper development of the children. They are to be treated as delicate, anemic individuals who need fresh air, appropriate exercise, and a roborant diet. Iron, in the form of ferrum pyro-

phosphoricum, and arsenic, as Roncegno-water, may be prescribed. A sojourn in the mountains will be very beneficial.

Vasomotor and Neurotic Albuminuria.—That nervous influences may produce albuminuria, though perhaps by way of circulatory disturbances, is proved by the experiments of G. Boeri, who saw albuminuria in the course of experimental neuritis and vagotomy. Here belongs probably the albuminuria after violent attacks of pain, as gall-stone colic and gastric crises, and after mental emotions. Some authors observed a family albuminuria in infants before they began to nurse.

The influence of the nervous system on the excretion of albumin has been undoubtedly demonstrated in diseases of the brain, spinal cord, and the meninges. Thus albumin is found in the urine after apoplectic attacks, epilepsy, and trauma; and in lesions of the skull, whereby a concussion of the whole body had occurred, glycosuria and albuminuria have been found. In the sediment there were granular casts and erythrocytes, which spoke for an injured circulation in the kidneys, causing a lesion in the parenchyma.

Traumatic Albuminuria.—Trauma, involving the renal region, may produce albuminuria; renal elements are usually absent, though the kidney parenchyma may have been crushed, but hematuria is present. On bimanual palpation, if only the lower pole of the kidney can be palpated, albuminuria may be produced in healthy individuals which lasts several hours. The sediment may contain red and white blood-cells, but no casts (J. Schreiber). If the kidneys are really diseased, the albuminuria does not disappear as rapidly, and thus an opinion may be gained of the function of the kidney.

Anesthesia and Albuminuria.—A slight degree of transient albuminuria is frequently found after narcosis, depending on the quantity of chloroform used and the duration of the sleep. According to Dérémans and Minet, it is almost constantly found in women, whereas only 52 per cent. of males show this phenomenon.

Toxic Albuminuria.—Many intoxications lead to albuminuria; though the conception that nephritis is present is not justified, it must, however, be conceded that gradual transitions exist. Iodin, tar, petroleum, carbolic acid, salicylic acid, phosphorus, lead, turpentine, and many other substances injure the kidney epithelium, but leave the glomeruli intact. The chronic abuse of alcohol injures the kidneys by its toxic action, as well as by the overexertion of heart and kidneys through the increased burden on circulation. This latter factor has to be considered chiefly in beer drinkers.

Infectious (Febrile) Albuminuria.—Febrile albuminuria is probably due to the action of bacterial toxins; the usual moderate

amount of excreted albumin goes parallel with the course of the fever. Harmless affections, as a follicular angina, often cause a manifest albuminuria, disappearing with the fall of temperature. The febrile albuminuria in the first week of scarlet fever bears no relation to the acute nephritis occurring usually in or after the third week. Here belongs the albuminuria appendiculaire of Dieulafoy, found in every severe perityphlitis.

Difficulty in the Passing of Urine.—If the passing of the urine is hindered for several days by obstruction of a ureter, as, for instance, in an attack of renal colic, retention of urine frequently leads to a transient albuminuria, characterized as renal albuminuria by the appearance of casts.

The albuminuria of pregnancy is in some cases due to the pressure of the pregnant uterus on the ureters, impairing the outflow of urine. But other etiological factors certainly play a rôle besides. This albuminuria of pregnancy occurs in 2 per cent. of all cases, passing usually without much significance, and only rarely introducing a severe disorder of the renal secretion.

Circulatory Disturbances.—Venous stasis, most frequently developing in cardiac insufficiency, leads to an engorgement of the kidney. If it persists for a longer period, attaining a marked degree, the pathologist speaks of cyanotic induration, and if secondary proliferation of the interstitial tissue, with breaking down of the specific glandular parenchyma has developed, we have the congested contracted kidney of Bollinger. The albumin excreted scarcely exceeds 2 pro mille. This slight quantity is of no decided value in differentiating congested kidney from nephritis, but the dependence of the albuminuria on the cardiac force is the important factor. The albuminuria may be caused to disappear in a few days by digitalis, which, of course, is entirely impossible in true nephritis. Yet in some cases the albumin excretion remains entirely uninfluenced on the improvement of the other cardiac manifestations, and then morbid pictures are produced, scarcely to be unriddled, in which we are in doubt whether we have a contracted kidney with breaking down of the cardiac force or a cardiac insufficiency with a secondary contracted kidney. Albumin in the urine immediately following delivery, epileptic attacks, suffocation, or compression of the thorax has probably, too, to be classed with the congestive albuminuria. Capillary hemorrhages of the skin following such an acute severe venous stasis prove how severely the circulation of the capillaries is injured.

The most severe degree of anemia is found in the anemic renal infarct. If we disregard this condition, albuminuria is otherwise not associated with anemia or with fluxionary hyperemia, but it may occur in severe primary diseases of the blood. According to v. Noorden,

albuminuria is by no means found more frequently in chlorotic individuals than in healthy ones.

Albuminuria in Bright's Disease.—In nephritis the occurrence of albumin is such a constant symptom that originally albuminuria was considered as an absolutely pathognomonic symptom of nephritis; as we know to-day, not correctly.

Nephritis sine Albuminuria.—Rare and even fatal cases of Bright's disease exist with complete absence of albuminuria. Probably because the exudate is present in such an enormous quantity in the glomeruli and tubuli that it does not permit the passage of casts and albuminous secretion into the bladder. Thus Herringham reports a case where only a high degree of oliguria was present; no albumin could be detected in the urine, whether by acetic, nitric, or picric acid. Postmortem an acute parenchymatous nephritis was found.

Globulin and Albumin.—Cloëtta believes that the relation of urinary globulin to albumin furnishes a better criterion of renal function than the intensity of the albuminuria. In acute nephritis, globulin appears first, in larger quantities. Later on this changes in favor of the serum albumin, until, before the complete disappearance of albumin from the urine, only serum albumin can be found. The latter furnishes the chief part of the albumin in chronic nephritis. This discrimination is for clinical purposes not of much value, as the separation of albumin and globulin is a very complicated process. Globulinuria proves a massy breaking down of renal epithelium; the relation of albumin to globulin in the blood may, in the urine, be changed in favor of albumin, as this is more diffusible than globulin, In minor disorders albumin alone may therefore appear in the urine the globulin being retained.

Albuminuria is not always the initial symptom of nephritis. Sometimes it is casts, in other cases a rapid increase in the body weight, or the retention of chlorids which permits the diagnosis of nephritis before albumin appears in the urine.

The quantity of albumin excreted reaches in the various kidney affections the following figures:

1. In hyperemia of the kidneys from traces to 1/2 pro mille.
2. In acute parenchymatous nephritis, 1 to 5 per cent.; 20 gm. or more in twenty-four hours.
3. In chronic parenchymatous nephritis the quantity varies from traces to 1 pro mille.
4. In interstitial nephritis, traces.
5. In amyloid degeneration, large quantities, especially of globulin.

The ingestion of raw eggs in Bright's disease increases the quantity of albumin excreted. The experiment is injurious through irritation of kidney epithelium.

Prognosis and Treatment.—The excretion of albumin, of itself, involves danger for the patients only in the most severe cases, as they perish much oftener from uremia, pulmonary edema, and other secondary changes than from the impoverishment of the organism in proteins.

The aim, therefore, to retain the protein equilibrium of the organism by hypernutrition with proteins, cannot be recognized as judicious; on the other hand, one will do well to give up the too careful restriction of the protein supply, from the fear of increasing the albuminuria. A. Pick proved by a series of systematic experiments years ago that the albuminuria was independent of the meat taken in. At the same time it was found that neither the sodium iodid, so much in favor in chronic nephritis, nor other drugs could lower the albumin content of the urine. Some authors even believe that the albuminuria is increased on a diet poor in proteins; thus v. Leube thinks that an insufficient covering of the protein demands, existing for a long time, weakens the resistance of the organism and especially of the heart, which then easily undergoes fatty changes.

That beef and other dark meat are prohibited is due to the irritating action of the extractives which they contain in large quantities. Yet the difference is very small, and v. Leube states with justification: "If one allows the patient one-third less beef than fowl and increases the quantity of milk correspondingly, everything that might be dreaded from the extractives is certainly more than neutralized."

In glomerular nephritis with oliguria, severe albuminuria, and normal urea excretion, meat and eggs may be given but the milk supply should be restricted, as a too large quantity of liquids would be introduced by its use.

If the tubuli are affected, the milk should cover the greater part of the protein requirement. Milk, as the exclusive nitrogenous food, will be indicated in threatening uremia, acute nephritis, and acute relapses of a chronic nephritis, as well as in the chronic hemorrhagic form.

In chronic nephritis the following standpoint may be taken: The patient is first kept on a milk and vegetable diet. This régime is observed as long as any diminution of the albumin excretion takes place. If this minimum remains constant for several days, an attempt to give meat may be made by administering a certain weighed quantity. If, on quantitative determinations, no increase in the albumin is found, the quantity of meat may be increased. Yet large quantities of meat, as 400 gm., are not indicated, because they tend to provoke autointoxication, which may prove dangerous in some cases, as the renal activity is impaired and the toxic products are only difficultly excreted.

Amyloid Kidney.—The diagnosis of amyloid kidney cannot be

made from the urinary findings alone. The demonstration of a pathogenic factor and of the presence of the same condition in liver, spleen, and intestines is necessary. The urine is clear, very rich in albumin, but poor in, or entirely free from, morphological elements. The conditions become more complicated on the presence of a co-existing nephritis, especially in amyloid contracted kidney.

Contracted Kidney.—In the genuine primary contracted kidney the albumin content is very small, scarcely exceeding 1/2 pro mille. This small amount of albumin may be the only symptom for years; indeed after long muscular rest, as in the morning, the urine may be completely free from albumin, whereas after muscular exertion, rich meals, and excitement albuminuria becomes manifest. Still slighter and later in appearance is the albumin excretion in the arterio-sclerotic contracted kidney. Cases of so-called "contracted kidney without albumin excretion" belong usually in this group. All gradual transitions to the noninflammatory, simple kidney atrophy, such as may occur in nutritive disorders of the kidney, especially in old age, may be found. There is never a high degree of albuminuria.

Gout and Albuminuria.—The uric acid diathesis leads sooner or later, but usually only after years, to contracted kidney; indeed the great part of the genuine interstitial nephritis is probably due to gouty kidney, though at present this can be proved neither clinically nor pathologically.

However, albumin is a frequent finding in gout. Among 1449 cases Garrod found it in 26.5 per cent., usually in the later course. The demonstration of albumin is seldom possible at the time of the first acute attacks, according to Minkowski. In longer standing cases of gout, the attacks are often accompanied by transient albuminuria; in rare cases it occurs earlier than the other symptoms of the attack, so that Garrod could predict an attack by the occurrence of albuminuria. Only after decades the albumin content of the urine may become constant, developing gradually into the picture of a chronic renal affection.

Uric Acid Infarct and Albuminuria in the New-born; Nephritis of Infants.—In the greater number of the new-born, albumin is found during the first ten days of life. This phenomenon probably stands in some relation to the uric acid infarction. The anatomical changes corresponding to the albuminuria are, according to Ribbert, to be found in the glomeruli. We are, therefore, not justified in thinking of inflammatory changes if the albuminuria does not extend beyond the tenth day of life. On its longer duration we will have to consider infantile nephritis, which not rarely shows a course without albuminuria, so that the renal affection can only be diagnosed by the sediment examination.

In hereditary syphilis this, too, may be negative. This explains the frequency of histological changes in the kidneys in hereditary syphilis and the relative rarity of the clinical diagnosis of a syphilitic nephritis. Thus Cassel found among thirty-one syphilitic infants only six with albuminuria; Kavornen found the urine normal in about five out of six syphilitic infants, and Hecker in ten out of twelve. Other infections and intoxications, as Möller-Barlow's disease, and, above all, the gastro-intestinal disorders of toxic or infectious etiology, lead to nephritis in infancy. The scarlet fever nephritis, so common in later childhood, is rare at this period of life.

The treatment consists in appropriate feeding, if possible breast feeding, and, if syphilis is suspected, in the specific treatment which must be interrupted at once if the nephritis becomes exacerbated.

Mucin and Nucleoalbumin.—Mucin and nucleoalbumin, even in normal urine, are present in small quantities, appearing as a slight cloud on the addition of acetic acid. Whether this cloudiness is due to mucin or to nucleoalbumin is not easy to determine, since in nucleoalbumin the content of phosphorus must be proved by the qualitative examination of the ash, whereas mucin contains a carbohydrate group. An increased amount of mucin is found in all catarrhal conditions of the efferent urinary passages, as well as on their irritation by toxins or in the course of infectious diseases. Nucleoalbumin is found when a large number of cells break down, as in diseases of the liver and kidneys, in leukemia, icterus, tuberculosis, and after the injection of antitoxic sera.

Occasionally albumin and nucleoalbumin or mucin, combined, appear in the urine, as in kidney diseases with involvement of the deferent urinary passages, and in acute gonorrhea.

Albumosuria.—Whenever albumoses are formed anywhere in the organism, or are resorbed in this form by the intestinal epithelium, they are excreted by the kidneys without the conclusion of a pathological condition in the kidneys being permissible.

Peptone appears, in the first place, if we adopt the terminology of Brücke, when in a purulent focus albumoses are formed under the influence of bacterial ferments (pyogenous peptonuria). Thus in pneumonia, in the resolution of empyemas, in purulent articular effusions and cavernous phthises.

Albumosuria may also arise from the absorption of albumoses from the food (enterogenous peptonuria). Moreover, the decomposition products of protein bodies may be absorbed from ulcerative surfaces without being again built up synthetically by the intestinal mucosa.

The test for alimentary albumosuria may therefore be used in deciding whether or not ulcers (typhoid, tubercular, or carcinomatous)

are present in the intestine. The liver, too, has the function of resorbing albumoses. Albumosuria may, under some circumstances, speak for a disturbed liver function, whether it be a gall-stone colic or an interstitial hepatitis (the hepatogenous peptonuria of Stadelmann).

Peptonuria may appear in carcinoma, wherever its seat; it is the expression of the increased breaking down of proteids, which here exists even in the afebrile periods. It may farther be found in intoxications and infectious processes of various kinds, as in the first or second week of involution of the puerperal uterus after the death of the child in the womb, in short in all instances where large masses of tissue are melting down; thus also in the acute yellow atrophy of the liver and in phosphorus intoxication. This last condition leads to another form of peptonuria, the nephrogenous one, as Miura has proved that albumoses are found in the kidneys in phosphorus intoxication. After injections of tuberculin, albumosuria may be observed, the albumoses being freed from the tubercular foci. The same symptom may be observed after the administration of antipyrin, guaiacol, etc., and after the injection of the tincture of iodin. Under the influence of ferments in the urine itself, the excreted albumin may, in part or in full, be transformed into albumoses. In severe cerebral affections, as apoplexy, embolism, and progressive paralysis, it may also be found.

Of importance are the findings of Krehl and Matthes, that in infectious and resorptive fevers albumosuria is present, whereas it is absent on overheating and puncture of the thermic center. Albumosuria may therefore be used to recognize the nature of a rise in temperature, and thus, for instance, it is possible by this means to determine that the rise of temperature after muscular exertion of a febrile tubercular patient is not the expression of heat accumulation nor of nervous thermolability, but has the significance of true fever.

In myeloma and sarcoma of the bone, heteroalbumoses are sometimes found in larger quantities in the urine. This symptom, called Bence-Jones albumosuria, has therefore a semiotic value in these conditions.

Pyuria.—Pus is found in the urine when in the kidney, ureter, bladder, or urethra it becomes mixed with the renal secretion. If in a pyelitis or pyelonephritis numerous erythrocytes are found in the sediment, one will always have to think of vascular erosion by kidney stones. In purulent cystitis, beside pus corpuscles, bladder epithelial cells and the usual sediment of an alkaline urine will be found ammonium magnesium phosphate and ammonium urate, since the urine is usually in ammoniacal fermentation, and therefore has an alkaline or at least neutral reaction.

By the examination of the sediment alone, cystitis cannot gen-

erally be distinguished from pyelitis; however, an abundance of bacteria and an alkaline reaction points more to cystitis, since these are rare findings in pyelitis and indicate a severe form.

Also the bacteriological findings of a purulent sediment are important; gonococci, staphylo- and streptococci, pyocyaneus and tubercle bacilli, and, in children especially, B. coli are frequently found.

Hematuria and Hemoglobinuria.—Hematuria and hemoglobinuria have been discussed in detail in the chapter on hemorrhage. Here it may be repeated that in renal hematuria, as constantly found in acute nephritis and in exacerbations of the chronic form, the content of albumin is always higher than would correspond to the number of red blood-corpuscles. Clinically, however, only a very small amount of blood and a very large amount of albumin will permit diagnostic conclusions. Microscopical examination of the sediment must clear up such uncertainties.

Hematoporphyrin is found in normal urine in traces. It may occur in larger quantities on the resorption of a hematoma, in intestinal hemorrhages, in paroxysmal hemoglobinuria, in liver affections, regularly in lead intoxication, and after large doses of trional and sulphonal.

Hematoporphyrinuria has been observed also in hereditary syphilis, but this symptom is of no importance for prognosis and treatment.

C. EXAMINATION OF THE SEDIMENT

Casts.—The most important elements to be found on microscopical examination of the urinary sediment are the urinary casts. Their characteristic form is due to their passage through the urinary tubules. There are forms, however, which are too broad to have passed Henle's loops and probably are derived from the dichotomous ramifications of the excretory ducts in the renal papillæ.

The true urinary casts always come from the kidneys and prove a disturbed function even if no albumin is found; but the finding of casts in jaundice and after salicylic acid medication constitutes an exception to this rule. The presence of casts without albuminuria has been observed in postsyphilitic coronary sclerosis, in liver cirrhosis and carcinoma of the liver, in general arteriosclerosis, etc., yet some authors believe this to be the sign of a chronic nephritis.

The occurrence of casts sometimes precedes the albuminuria at the onset of an acute nephritis, so that the examination of the sediment is of great value for its early diagnosis. On the other hand, casts may be completely absent in the urine of Bright's disease; they may have been dissolved under the influence of bacteria; as, for instance, the colon bacillus.

Number.—The number of casts varies according to the kind of renal affection. They are most frequent in the acute and chronic parenchymatous nephritis, most rare in the congested kidney, in primary and secondary interstitial nephritis, and in amyloid kidney.

Kinds.—According to their structure we distinguish three chief groups:

1. Cellular casts.
2. Granular casts.
3. Amorphous casts.

The cellular casts are built up usually from renal epithelia or from erythrocytes; leukocytes often adhere to the casts, announcing thereby their derivation from the kidney parenchyma, but only exceptionally can a cast be found which is composed entirely of them.

Granular cast may contain coarse and fine granules, grainy albuminous detritus, and fat droplets. They develop by parenchymatous or fatty degeneration of the epithelial or amorphous casts.

Amorphous casts may be hyaline or waxy; hyaline casts are indeed often found under almost physiological conditions; at least it can be said no inflammatory irritation of the kidneys is necessary to their appearance.

Origin of Hyaline Casts.—The opinion that in hyaline casts we have to deal with fibrinous coagula of transudated blood serum, has been abandoned in favor of the theory of the metamorphosis from epithelial cells and epithelial casts, since epithelial casts may sometimes be observed which are in part hyaline.

Significance of Hyaline Casts.—Hyaline casts are found not only in nephritis, but also in congested kidney; farther, in the somewhat albuminous urine in the course of chronic diseases, when, toward the fatal end, circulatory disorders develop; before death, due to loss of blood; in peritonitis, as a symptom of threatening collapse; in exudative pleurisy (furnishing a vital indication for puncture); and finally in states of irritation of the mentally afflicted. Waxy casts sometimes give an amyloid reaction, but have nothing to do with amyloid kidney. They have been observed in the nephritis of scarlet and typhoid fevers. Cylindroids or cylinder-like accumulations of urates, or cocci, and mucin coagula can easily be distinguished from true casts with some experience.

Casts Covered with Different Elements.—The corpuscular elements precipitated on the casts deserve some attention. Uric acid casts are usually hyaline casts covered with uric acid or urates, and occur especially in gouty kidney. Red and white blood cells, hematoidin crystals, and renal epithelia adherent to the casts permit certain conclusions as to the anatomical changes in the kidney parenchyma.

Casts in Renal Embolism.—Of great importance for the differential diagnosis between infectious embolic nephritis and the noninfectious embolism of the kidney is the finding of epithelial casts, since these are found in infected embolism, but not in that due to cardiac insufficiency (infarct). Erythrocytes and their fragments may form casts which are of a granular appearance and are found in both embolic processes.

Since the infected foci constitute part of the symptom-complex of pyemia, the condition associated with it will be of very unfavorable prognosis.

Single casts may, according to Serkowski, be found in hyperemia; hyaline, long and narrow casts in amyloid kidney, without nephritis; broad, hyaline and finely granulated casts in fatty degeneration of the kidneys, chronic interstitial nephritis.

Numerous casts of various kinds may be found in acute, hemorrhagic, and purulent nephritis, amyloidosis and tuberculosis with nephritis, cholera nephritis, senile noninflammatory atrophy.

Unorganized Sediment.—Unorganized sediment of the urine may contain:

1. Uric acid, hippuric acid, amido-acids.
2. Cystin, tyrosin, xanthin, bilirubin, indigo, and other coloring matters.
3. Uric acid salts, phosphoric acid, alkaline earths, carbonates, and sulphates.

The condition necessary for their appearance may arise in the bladder itself or only after the cooling off of the excreted urine.

In acid urines, especially if concentrated, urates are generally found, beside calcium oxalate, and in rare cases calcium sulphate. The urates form a yellow or rose-red powder which precipitates slowly, known as the *sedimentum lateritium;* it appears in healthy persons after violent sweating or great thirst, as in the summer time; further, in febrile conditions, as in pneumonia. Otherwise the symptomatic significance of the unorganized sediment is soon exhausted.

Cystin proves an habitual metabolic anomaly (cystinuria); tyrosin is found in acute yellow atrophy of the liver, together with leucin, which, however, in its characteristic ball form can only be found in the alcoholic extract of the urine. The earthy phosphates generally only prove the alkaline reaction of the urine, a fact which on the addition of NaOH to normal urine can be demonstrated at once *ad oculos.*

Phosphaturia is found, sometimes alternating with oxaluria in sexual neurasthenia, in irritation of the bladder, chronic gonorrhea, masturbation, frequent pollutions, etc. In recent times, phosphaturia has been connected with a disturbed excretion of calcium salts

by the intestine. Ammonium magnesium phosphate and ammonium urate will only be found in ammoniacal fermentation of the urine.

Organized Sediments, aside from Casts.—Single epithelial cells from the urinary passages, mucous and pus corpuscles, and large pavement epithelial cells from the vagina are found in the normal urine in slight quantities.

The amount of pus contained in pathological urine may increase to such an amount that in severe pyelitis, cystitis, and on pus perforations into the urinary passages, it may form a thick layer; in alkaline urine it becomes swollen into a viscid, formless mass, adherent to the vessel.

Of great importance are the red blood-corpuscles and the renal epithelial cells which can only be diagnosed after long experience. In spermatorrhea one finds spermatozoa even in the immature forms usually only found in the testicles. In sperma-containing urine one finds also cylindric epithelia, round bodies enclosing lecithin granules, testicle cells, amyloid corpuscles, spermatocytes, hyaline globules, and in rare cases hyaline casts which are derived from the testicles. Of importance, further, are urethral threads, which point to a chronic urethritis. In many cases, however, they are of no significance (free from pus corpuscles), but they may be the cause of a sexual neurasthenia and hypochondria. Tumor particles in papilloma of the bladder and in villous cancer, elastic fibers, and dead pieces of connective tissue in tuberculosis of the uropoietic system, micrococcus urea, sarcinæ, and, in diabetic urine, yeast cells, and urinary concrements whose composition may be suspected from their color, structure, and firmness, may further be found in the sediment.

D. GLYCOSURIA

Definition.—Not every excretion of sugar is a glycosuria, for glucose is only one of the sugars occurring in the urine, though, indeed, it is by far the most frequent one. Since lactose, levulose, pentose, etc., appear only rarely in the urine, we will understand by the term sugar excretion, glycosuria.

Glycosuria and Diabetes.—A persistent, though only slight degree of glycosuria, is always the sign of a diabetes mellitus, under which term, however, we, to-day, understand no nosological entity.

Alimentary Glycosuria.—*Glycosuria ex Saccharo.*—Transient glycosuria occurs also in healthy persons, if sugar is taken in, in a quantity which exceeds the limits of assimilation. This alimentary glycosuria, *glycosuria ex saccharo*, by no means proves the existence of diabetes. However, in aglycosuric periods of diabetes, as, for instance, after diet cures, this alimentary glycosuria is especially easily provoked.

On an empty stomach or if followed by rest, the ingestion of sugar, whether dextrose or cane-sugar, may produce a sugar excretion even after doses of 50 gm. For comparative observations one may use that quantity of sugar which may be introduced pro kg. body weight without producing glycosuria, the assimilation limit of Hofmeister. In rickety children, 2 to 6 gm. dextrose on an empty stomach are sufficient to produce glycosuria (Nobécourt).

Glycosuria ex Amylo.—In opposition to the alimentary glycosuria following ingestion of sugar, the glycosuria following the ingestion of carbohydrates free from sugar is always of pathological significance—glycosuria ex amylo. The first is found on disturbance of the liver function, especially in cirrhosis, because the blood of the vena porta reaches the vena cava inferior, in some part, through newly developed collateral veins, without passing through the liver, which normally absorbs the sugar from the blood of the portal vein. True alimentary glycosuria ex amylo is not observed in liver cirrhosis according to Quincke, v. Frerichs, v. Noorden, Naunyn, and others. The sugar excretion, on overfilling of the intestines with sugar solutions, is due to the resorption of the sugar by the lymph vessels, whereby it escapes the portal circulation. Alimentary glycosuria ex saccharo has been observed in Graves' disease, in traumatic and other neuroses, in delirium tremens, in severe drunkenness, in old hemiplegic individuals, in anemia, chlorosis, and during pregnancy, in febrile infectious diseases, affections with abundant diuresis, whether pathological or caused by drugs, in diabetes insipidus, and in chronic lead intoxication. The most common form of alimentary glycosuria is that following trauma.

Test and Differential Diagnosis from Diabetes.—In testing for alimentary glycosuria ex saccharo, one gives 100 gm. dextrose, not on the empty stomach, but two hours after a breakfast consisting of one cup of coffee with milk and 80 to 100 gm. bread (Naunyn). We make use of this method if a beginning diabetes mellitus is suspected, whose full outbreak, however, may still take years. If the urine contains more than 1 per cent. of sugar or more than 2 or 3 per cent. of the total quantity of sugar ingested, the diagnosis of diabetes mellitus may be made with great probability. To clear up the question one may make another test by administering floury foods with other abundant nourishment. If a latent diabetes mellitus is present, true alimentary glycosuria will be found, if not at once, after a few days.

Accidental Glycosuria.—Different noxæ may cause a transient excretion of sugar, thus febrile diseases, intoxications with sublimate, carbon monoxid, amylnitrite, and certain alkaloids, as atropin, morphin, but also other drugs, as salicylic acid and ergot.

According to F. Blum, the injections of suprarenal extract pro-

duces glycosuria even in the state of inanition and on a diet free from carbohydrates. Anesthesia also is not rarely followed by an excretion of a considerable amount of sugar. It is possible that we have to deal with the influence of the narcotic sleep alone, for inhalation of ether without narcosis does not produce this symptom. Claude Bernard produced a transient but considerable glycosuria by a lesion of a certain point lying on the floor of the fourth ventricle (diabetic puncture). The region lying around this point may produce polyuria and albuminuria.

After experimental lesions of different regions of the central nervous system and of the peripheral nerves, excretion of sugar may occur. Also clinically, there exists an unmistakable connection between nervous diseases and glycosuria or even diabetes mellitus.

Thus in hemorrhage, especially if of a severe nature, and in softening of the cerebral hemispheres, in tumors, especially of the cerebral peduncle and cerebellum, in progressive paralysis, contusion of the brain, multiple sclerosis, tabes, purulent and epidemic meningitis, myelitis, affection of the sympathetic vagus, neurosis, and traumatic functional disorders, diabetes has been observed. In 34 per cent. of all neurosis due to accidents, alimentary glycosuria has been observed. However, we must avoid an erroneous interpretation, since diabetics suffer, not rarely, later on from functional and organic nervous diseases, which develop, like purulent meningitis, from the resistance lowered by the hyperglycemia or from a primary cause identical with that of the diabetes, as arteriosclerosis or syphilis.

Phloridzin is believed to produce renal glycosuria without a simultaneous increase in the content in blood-sugar. It acts by rendering the renal epithelium permeable for sugar or, what seems more plausible, by a continual splitting and synthesis, in the manner of catalyzing enzymes. Phloridzin is a glycoside, a compound of sugar and phloretin. This compound is split up in the kidney; the phloretin, set free, combines with the available blood-sugar, and thus blood-sugar is excreted until the phloretin has left the body, which usually is soon accomplished.

Glycosuria in Diabetes Mellitus.—The sugar excretion in diabetes mellitus provokes first an abundant diuresis, with its injurious influence on the balance of energy. Of much more weight is the loss of sugar, representing a considerable loss in calories. A diabetic loses many more calories than can be figured out from the sugar excreted in the urine, as he must first form the sugar from proteids with loss of energy.

The chief danger of glycosuria lies in the loss of energy only in severe cases. In the lighter forms the danger lies in the tendency of the glycosuria to increase steadily; this tendency is much more pro-

nounced at an early age than in advanced age. On the other hand, the tolerance for carbohydrates improves if we succeed in getting the patient free from sugar. The real danger lies, of course, back of the glycosuria in the hyperglycemia. Through the infiltration of the tissues with sugar, infection by bacteria is rendered very easy, as microorganisms grow well on sugar-containing media. Indeed, bacteria which like sugar, but which in general are not pathogenic for man, as some hyphomycetes, may produce abscesses, and the resistance of the organism is considerably lowered even against such bacteria as are injured by the addition of sugar to the culture medium. The acidosis is not in direct relation to the sugar excretion, and will be discussed with acetonuria. A series of other complications is dependent on the loss of energy and the lowered resistance of the tissues, such as diabetic gangrene, pulmonary tuberculosis, neuralgia and neuritis, impaired accommodation, cataract, iritis and retinitis, and severe purulent otitis.

Other Rare Forms of Melituria.—Levulose is excreted in rare cases in severe functional neuroses. The case of levulosuria, described by Rosin and Labaad, is of interest: Levulose ingested did not cause an increase of the amount of levulose in the urine and was, therefore, normally burned up; the levulose of the urine must have come from an unknown source.

The dextrosuria, with rotation to the left, must not be mistaken for levulosuria; it is due to the presence of some conjugated glucuronic acid, which rotates strongly to the left; for instance, urochloralic acid after the administration of chloralamide (Naunyn).

Lactosuria never occurs in pregnant women, but on the day of delivery in 80 per cent. of all women who do not nurse their children. The sugar content of the urine rarely exceeds 1 per cent. It is well to know this fact to avoid the erroneous diagnosis of diabetes in the puerperium.

E. ACETONE AND ACETO-ACETIC ACIDS IN THE URINE

Source of Acetone.—*Proteids.*—The question as to the origin of acetone is still unsettled. Originally it was believed that a pathological splitting of the protein molecule was necessary for its production, and the acetonuria of the diabetic, fed on a meat diet, and of the starving individual was connected with the decomposition of proteins. That the proteins of the food have to be regarded as a source of acetone production is difficult to demonstrate. For by an exclusive nourishment with albuminous food, the calorific requirements of the human organism can scarcely be completely covered, and thus the production of acetone from the split body proteids cannot be excluded.

However, even against this mode of origin, weighty objections have been raised. In some diabetics who were kept in complete metabolic equilibrium acetone has been found in the urine. The patients may feel entirely well, and even increase considerably in weight.

Carbohydrates.—The carbohydrates of the food cannot be considered as acetone producers, since acetone appears just on their exclusion from the diet, and may disappear when they are again introduced. Also within the organism the carbohydrates, which in severe diabetes leave the body entirely unchanged, can scarcely be considered as progenitors of acetone, as Pflüger was inclined to believe (P. Fr. Richter).

Fat.—Thus in recent times fat has been accepted more and more as the source of acetone. The addition of fat to the diet doubtless leads to an increased amount of acetone. In accord with this opinion is the appearance of acetone in diseases associated with protein catabolism, as fever, hunger, phosphorus intoxication, etc., because in these cases body fat is constantly melted down at the same time. This melting down of body fat must, however, occur in a peculiar, pathological way, for in anti-fat cures acetonuria is never observed. Also this conception is not completely satisfactory, for it does not explain the cases of acetonuria with simultaneous deposition of fat. Blumenthal therefore believes that only the fat ingested can be considered as the source of the acetone, not the body fat which is consumed on starvation. In accordance with this is the fact that butyric acid does not increase the amount of acetone if injected subcutaneously, but does if taken internally.

Present Conception.—To-day the standpoint is generally taken that whether it is the proteid or the fat or both which have to be considered as the mother substance of acetone, acetone is constantly found when the carbohydrate metabolism takes an abnormal course.

Seats of Formation of Acetone.—The seat of formation of acetone bodies is in some cases the gastrointestinal tract, but not alone, for the quantity of acetone there formed is far exceeded by that appearing in the urine and expired air. Therefore the intermediate metabolism has to be postulated as a source of acetone formation.

Review of the Occurrence of Acetonuria.—According to v. Jaksch, acetonuria is found:

1. In febrile diseases, especially in children.
2. In diabetes.
3. In carcinoma without cachexia.
4. In inanition.
5. In nervous diseases and psychoses.
6. In digestive disturbances and autointoxications.
7. After chloroform and ether anesthesia.

Diaceturia and Acetonuria.—Beside acetone, diacetic acid appears in large quantities if acetone is present. Diaceturia has, therefore, a similar significance to acetonuria, but is prognostically more unfavorable. Both substances are derivatives of β-oxybutyric acid which, too, may appear in the urine. The diacetic acid, on the other hand, is the mother-substance of acetone, which is very easily separated from it by decomposition. We therefore may find acetone in the urine alone, but never diacetic acid. Diaceturia appears together with acetonuria on the first day of starvation; in fever, only in a high degree of anorexia and severe emaciation. Some infectious diseases show a special tendency to diaceturia; thus the streptococcus infection, whereby we have to deal with the specific influence of the bacteria. The presence of aceto-acetic acid in adults always announces a severe course of an infectious disease, which is not the case in children.

1. Febrile Acetonuria.—Some forms of acetonuria and diaceturia demand special consideration. Febrile acetonuria in adults is a very serious, though not a frequent, symptom. In typhoid fever it is seldom found, but if a diabetic, who previously gave Gerhardt's reaction, is taken with typhoid this reaction becomes much more pronounced without any change occurring in the excretion of sugar. At the height of fever it is of no significance. If it occurs suddenly in the third week we will think of intestinal hemorrhage. If present after defervesence it indicates that inanition is imminent and demands more ample nourishment for the patient.

In exanthematic typhoid and in severe attacks of malaria it is more frequently present in the urine secreted during the fever.

In Asiatic cholera acetone and diacetic acid are found in the algid stage as well as in the stage of reaction.

In the acute exanthems, especially measles and scarlet fever, large quantities of acetone are found in the urine, also in harmless anginas, in which the fever, as v. Noorden emphasizes, may be even very low. Very striking is the acetonuria in tonsillar abscess. In diphtheria very little or no acetone is excreted, unless a mixed infection with streptococcus governs the picture. Acetonuria is found, further, in acute general miliary tuberculosis, violent exacerbations of chronic pulmonary tuberculosis, in croupous pneumonia, and in septic processes of various kinds.

In infancy as well as in childhood a certain tendency to intermediate acidosis has been proved, so that the patient in the first decade of life may show acetonuria and diaceturia in any febrile affection (Meyer and Langstein).

2. Acetonuria in Diabetes Mellitus.—In diabetes mellitus acetone occurs in the urine constantly if the patient is in the state of

hyponutrition. The excretion of acetone, diacetic acid, and β-oxybutyric acid increases just before the diabetic coma appears and again toward the end. Naunyn observed also in intercurrent febrile diseases, as influenza, a considerable rise in the acetonuria, which persisted throughout the fever. One cannot therefore always make the prognosis of imminent death from its appearance, though its significance may, all in all, be considered unfavorable. The acetone in the urine is no measure of the degree of acidosis, as it would be necessary to make a simultaneous determination of aceto-acetic and β-oxybutyric acid, which, at present, cannot be done accurately. Further, the acetone of the expired air would have to be considered.

In light cases of diabetes, the quantity of acetone in the exhaled air is the larger, whereas in severe diabetes the amount excreted in the urine is greater. Acetonuria plays an important rôle in the theory of diabetes. For its detection one uses best Gerhardt's ferric-chlorid reaction, though it really indicates the presence of diacetic acid. If the urine, on addition of ferric chlorid, becomes not only wine-red, but dark violet, almost black, a threatening acidosis is present. In this case one will do well to interrupt at once the severe diet and give the patient milk and cellulose beside his monotonous protein and fat diet. The metabolism here is so severely disturbed that it is impossible to protect the patient from the rapid decline without carbohydrates. This, again, increases the danger of hyperglycemia.

Strict individualization and constant regulation of the diet, with control of the general symptoms and exact quantitative determination of the urinary constituents, often permit us to avoid the dangers of this vicious circle. In these cases the alkaline treatment will be indicated; this is taken up in the consideration of diabetic coma.

3. Acetonuria in Cancer without Cachexia.—In patients suffering from malignant tumors, especially carcinoma, acetone, and diacetic acid are occasionally found, sometimes even β-oxybutyric acid. Whereas the β-oxybutyric acid occurs only toward the end and in small quantities, in those cases especially in which a terminal course develops, acetonuria and diaceturia are found even in a relatively good state of nourishment, even in patients who still eat sufficiently. This symptom, which never occurs in the initial stage, but only in the fully developed morbid condition, is probably due to a toxogenous decomposition of proteids, especially of muscle substance. The quantity of the protein decomposed depends on the toxin production in the tumor. The breaking down of the protoplasm persists even on abundant nourishment. Indeed, we may increase the food and with it the nitrogen supply as much as we wish, but the nitrogen output will exceed it, nevertheless. Carbohydrates, by their protein-economizing action, will be the most appropriate

food to cover the loss of protoplasm, at least for a short time. The excretion of acetone bodies may cease completely for a short period.

In severely ill carcinomatous patients, above all when the tumor is located at the pylorus, or in stenosis of the esophagus, inanition is associated with the specific carcinomatous intoxication. It is then difficult to estimate rightly the part which each factor plays in the breaking down of muscle substance and in the formation of acetone bodies.

4. Acetonuria in Inanition.—On absolute abstinence from food the demand is covered, in proportion to the state of nutrition, by the fat deposition alone; but if this is absent, the protein stock of the body is at once attacked. It is a peculiar fact which obscures the question as to the origin of the acetone bodies, that the appearance of acetone goes parallel neither with the fat metabolism nor with the decomposition of proteins. The partisans of the theory that acetone is formed from the body fat point out that the starving artist, Succi, who started his experiment with a large stock of body fat, showed very soon a marked acidosis, whereas individuals poor in fat may starve a long time without excreting acetone bodies. However, those who hold to the formation of acetone from the decomposition of body proteins may point out that "fat-less" individuals, on starving, always destroy more fat than protein, so that the absence of acetone cannot be ascribed to an absence of fat decomposition.

The acetonuria and diaceturia of inanition may appear as early as the first day in starvation. On a minimal supply of food or on absolute abstinence, due to hysterical anorexia on cauterization of the esophagus, or in any other affection leading to inanition, but not to protoplasm destruction, v. Noorden observed abundant quantities of acetone and diacetic acid even on the first day. The excretion of acetone bodies behaves differently in chronic hyponutrition, even if 12 to 13 calories pro kilogram body weight are supplied daily. Acetonuria is then present, but no diaceturia, the latter developing only when the patient is completely exhausted. Both symptoms disappear in one to two days after an abundant food supply. In advanced inanition, β-oxybutyric acid has been observed in the urine.

On exclusive protein feeding acetone bodies may sometimes be found in the urine. It was believed that this acetonuria was due to the increased decomposition of the nitrogenous foods so abundantly supplied, until v. Noorden proved that the exclusive protein diet acts only as a starvation diet, since the calorific demand cannot be covered by it, and that the addition of carbohydrates at once causes the acetonuria to disappear. If the carbohydrates preponderate in the diet of hyponutrition, no considerable amount of acetone is excreted.

v. Noorden relates a case where acetonuria and diaceturia, appearing after three days of starvation, disappeared the next day after the addition of 90 gm. cane-sugar and 150 gm. starch.

5. Acetonuria in Nervous Diseases and Psychoses.—Hyponutrition has to be considered as the cause of acetonuria in nervous and mental diseases. In patients with melancholia, who refuse nourishment, its occurrence is by no means due to a specific anomaly of metabolism peculiar to this disease, though it must be confessed that the rapid loss of weight is not to be explained by the insufficient supply of food alone. If violent vomiting (hysteria; gastric crises) frustrates any attempt to supply food, a marked degree of acetonuria will soon be observed.

6. Acetonuria in Digestive Disturbances.—*Stomach.*—As far as diseases of the stomach are concerned in the origin of acetone bodies, a disturbance of its secretory function is of no influence on the intermediate metabolism. Motor insufficiency may produce, by inanition, an acetonuria which may, in pyloric stenosis, attain very high degrees. Noteworthy is the demonstration of acetone in the stomach contents in stagnation and in fermentation processes. However, the quantity of acetone is too small to explain the simultaneously existing acetonuria by resorption from the stomach contents.

Intestines.—In severe intestinal disorders, acetone, aceto-acetic acids, and in rare cases β-oxybutyric acid have been found; and secondary nervous manifestations, as convulsions and coma, have been ascribed to the acid intoxication. However, in recent times, the improbability of this connection has been demonstrated by v. Noorden, Müller and Brieger, and others, who see in the appearance of these substances only the expression of broken-down body substance and thus of hyponutrition—in general, and not of that occurring merely in intestinal disorders. Other authors, however, as Strauss and Philippson, believe in an enterogenous acetonuria, considering the fatty acids of the intestines as the source of the acetone bodies.

Recurrent Vomiting with Acetonuria.—In boys between the second and eighth years of life, less frequently in infancy and at the age of puberty, attacks of periodical vomiting with acetonemia have been observed (Comby). In full health nausea appears, followed by uncontrollable vomiting which after lasting for hours or days disappears just as suddenly as it came. After an interval of weeks or months the same manifestations may recur. At the period of vomiting acetone, diacetic acid, and β-oxybutyric acid make their appearance in the urine, the expired air has an odor of acetone, and the question to be decided is whether the acidosis has to be considered as the consequence of hyponutrition or as the cause of vomiting. For the latter opinion speaks the fact that acetonuria may precede the act of vomit-

ing and also outlast it for some time. However, from the investigations of v. Jaksch and Meyer and Langstein, we know that childhood especially tends to acidosis, without the symptom of uncontrollable vomiting being associated with the severe acetonuria. In regard to the pathogenesis of acetonuric vomiting, an obscure uric acid diathesis, hysteria, acid intoxication, and even pseudomeningitis, on the basis of an intestinal autointoxication, have been blamed.

In regard to the differential diagnosis, confusion with appendicitis and tubercular meningitis must be avoided. The prognosis of the recurrent vomiting is usually favorable, though fatal cases have been observed where postmortem no satisfactory explanation has been obtained.

The treatment must be symptomatic, and should combat the impoverishment in water and the acidosis. Small portions of ice-cold drinks are given, thirst enemas, and, if necessary, 100 c.c. of physiological salt solution in subcutaneous injection once or twice a day. Alkalies will have to be tried against the acidosis, though the effect will be small on account of the obstinate vomiting; even if large doses of sodium carbonate and phosphate have been incorporated, until the amphoteric reaction of the urine appears, no marked results are obtained. Those salts of plant acids which are transformed in the organism into carbonates act, of course, in the same way as the alkalies. Marfan advises sugar-water, believing that the carbohydrates decrease the formation of β-oxybutyric acid in the same way as in diabetic acidosis. In the free intervals he gives regular doses of alkalies; of the following mixture, a wineglassful before meals:

Rp.	Natr. sulfur.,	10.0
	Natr. phosphor.,	5.0
	Natr. bicarbon.,	5.0
	Natr. bromat,	3.0
	Aq. destill.,	1000.0

Liver.—Diseases of the liver due to an insufficient urea-producing function lead to an increased excretion of nitrogen by the urine in the form of ammonia. Sometimes in phosphorus poisoning it is, however, simply the expression of an abnormal acid formation in the organism, due to decomposition of proteids by protoplasmic poisons, and then acetone also may appear in the urine.

Autointoxication.—In gastrointestinal autointoxication, in sausage, meat, and cheese poisoning, acetone is sometimes found; however, acetonuria is here only a symptom and of no causal importance for the severe manifestations produced by the other poisons.

Blood Diseases.—Acetonuria and diaceturia are also sometimes observed in severe anemias and in leukemia. The appearance of the

acetone body is probably due to the hyponutrition associated with these conditions. The decreased oxidation power of the organism may perhaps prevent the combustion of small quantities of acetone produced by an abnormal fatty acid production in the intestine, and then it appears in the urine. After extensive hemorrhages, especially into the intestine, it is commonly found.

7. Acetonuria after Anesthesia; 8. Acetonuria in the Puerperium.—After chloroform and ether anesthesia acetone may appear in the urine, and a case of death after ether narcosis is reported which occurred with symptoms of acetonemia. The most plausible explanation lies in the toxic influence of the narcotics on the proteins, which is expressed in the extensive fatty degeneration of the musculature. The acetonuria of pregnancy, labor, and puerperium is of no pathological significance.

F. AMMONIA IN THE URINE

Increase in the Ammonia of the Urine.—Through Acid Formation.—The quantity of ammonia excreted by a healthy adult in one day on a mixed diet varies between 1/2 to 1 gm. It is lower on vegetable diet, higher on animal diet. This is due to the fact that on meat diet sulphuric and phosphoric acids appear for whose neutralization the fixed alkalies are not sufficient, whereas on vegetable diet an excess of alkali exists which appears in the urine as carbonates. Therefore, ammonia is removed from the urea production by free acids, as they can only pass into the urine when neutralized. It is thus possible experimentally to increase the ammonia content by a supply of acids and to decrease it by that of alkalies, though ammonia can never be completely removed, even on the most extensive hypersaturation of the organism with alkalies (Magnus Levy).

Through Liver Insufficiency.—Any injury to the urea production in the liver causes an increased elimination of ammonia. In Eck's fistula we have to deal with an augmentation of ammonia caused purely by liver insufficiency, whereas in liver diseases, as in cirrhosis and acute yellow atrophy, the injured function of the liver is associated with an abnormal production of acids, for the urine remains acid even when large quantities of alkali have been administered.

Through Loss of Alkali.—The removal of fixed alkali, as it occurs in the loss of alkalies and alkaline earths through the intestines of infants affected with gastrointestinal disorders, may play a certain part; besides, this "relative acidosis," as well as the true acidosis of the diabetic, is believed to cause an increased excretion of ammonia in the interest of the alkaline deposition in the organism. It is possible that, beside the relative acidosis, one due to abnormal acid

formation may be present, especially in children with gastrointestinal disorders (recurrent vomiting with acetonuria).

Through Ammoniacal Fermentation.—Ammoniacal fermentation of the urine occurs constantly if the urine has been evacuated for some time. Ammonia determinations, therefore, must be made only with entirely fresh urine. Ammoniacal fermentation may occur in the bladder, so that in cystitis the freshly excreted urine may smell of ammonia and give the alkaline reaction. However, this symptom is not a common or necessary attribute of cystitis.

Ammonia in the Urine in Liver Diseases.—The experimental results obtained after exclusion or obliteration of the liver are not completely confirmed by clinical observations. Whereas Weintraud found the relative ammonia value, *i.e.*, the relation of the ammonia N to the total N, increased to double the normal average in two cases of severe cirrhosis of the liver, other authors found in amyloid affections of this organ no increase, and indeed even a decrease in the ammonia eliminated.

In Toxogenous Proteid Decomposition.—Increased decomposition of proteid leads to an abnormal acid production in the intermediate metabolism and to an increase of ammonia.

1. *Fever.*—In febrile diseases, such as typhoid fever, pneumonia, pleurisy, rheumatic polyarthritis, cholera, etc.; the relative value of the ammonia elimination may amount to four times the normal.

2. *Carcinoma.*—In carcinomatous patients, especially if in a bad state of nutrition.

3. *Uremia.*—In nephritis with uremic intoxication. The toxins of uremia cause a toxogenous decomposition of protein, and thus the increased elimination of ammonia is due to the abnormal production of acid; and it is not, as Frerichs has believed, the ammonemia which causes uremia, a theory whose untenability v. Noorden has proved by the demonstration of analogous conditions in other intoxications.

4. *Diabetes Mellitus.*—In diabetes mellitus, where the β-oxybutyric acid needs large quantities of ammonia for its neutralization, Hallervorden, in severe cases of diabetes, found the daily excretion of ammonia increased to eight times the normal. All the cases in which this increased elimination could be found had a diet which might give rise to the production of acid. They ate a great deal of meat, whereby large quantities of phosphoric and sulphuric acid appeared in the intermediate metabolism, and thus the simplest conclusion was that by these organic acids the organism became impoverished in alkalies, which resulted in the compensating production of ammonia. Later, however, Stadelmann discovered in the urine of diabetic patients an abnormal acid, which he believed to be α-crotonic acid, whereas Minkowski and Külz recognized it as β-oxybutyric acid. With this

was founded the doctrine of acidosis and acid coma in diabetes mellitus.

Carbon Dioxid Poisoning.—In diseases of the respiratory and circulatory organs lactic acid is produced under the influence of the want of oxygen and the oversaturation of the blood with CO_2. This, however, does not lead to any considerable increase of ammonia in the urine, which is within the normal limits.

The Acid Theory of Keller.—Keller found in the urine of infants suffering from intestinal disturbances a considerable increase of ammonia, so that in pronounced cases almost one-half of the total nitrogen excreted appeared as ammonia in the urine. The first explanation offered for this was the insufficient function of the liver to produce urea. On the other hand, the criterion of Hijmans van der Bergh and of Schröder-Münzer pointed to an acid intoxication; it consisted in the fact that the increased ammonia elimination in the urine, due to acid formation in the intermediate metabolism, could be caused to disappear by the administration of alkalies. However, we do not have to deal with an acidosis proper, but with a deprivation of alkali by the free fatty acids of the intestines which attack the fixed alkali of the organism for their saponification. Thus soap stools are frequently observed in chronic nutritive disorders, for the loss of alkali is only insufficiently covered by the production of ammonia.

Though the doctrine of acidosis will perhaps in the future be abandoned to some extent, it is certain that it has led practically to important results. We have learned that it is advantageous to decrease the fats in the nourishment of infants with gastrointestinal affections. At the same time, we have gained a definite indication for the use of Keller's milk-malt soup and of buttermilk, two foods of immense value in the treatment of infantile diseases. Prophylactically, too, we have gained much, for we may avoid the injurious results which a persistent overfeeding with fat may produce.

Therapeutical Considerations.—In daily practice we will not be guided by the ammonia elimination in controlling a threatening acidosis; this is due to its somewhat complicated quantitative determinaton. Diabetics who, according to Legal's test and Gerhardt's ferric chlorid reaction, are in a dangerous condition must receive carbohydrates, milk, bread, and, besides, large quantities of alkalies (sodium bicarbonate), until the urine no longer gives an acid reaction. Sometimes excessive quantities are needed for this purpose.

Ammonemia.—If there is an ammoniacal fermentation of the urine within the organism whereby the freshly excreted urine shows an increase in the ammonia content, a true ammonemia may result, leading to anorexia, a distaste for meaty foods, vomiting, diarrhea, sometimes even to a severe state of collapse, which has nothing to do

with the ammonemia which formerly was supposed to be present in uremia.

The treatment must aim to arrest the overproduction and resorption of ammonia; if urinary retention exists, a free outflow for the urine must be procured at once by the usual urological methods; catheterization, urethrotomy, and puncture of the bladder will have to be considered. Lavage of the bladder with boric or salicylic acid will be advantageous. Though there may be no danger of ammonemia, the ammoniacal fermentation of the urine is a symptom whose removal is to be desired, the more as the bladder is greatly irritated by the alkaline reaction. Where the urinary flow is unimpaired, internal urinary disinfectants will sometimes be sufficient, salol, urotropin, hetralin, or helmitol. By these means we often accomplish a restitution of the acid reaction of the urine in a short time and thereby avoid the vicious circle in cystitis mentioned above.

G. AROMATIC SUBSTANCES IN THE URINE

General Remarks.—The decomposition products of proteins, which belong to the aromatic series, usually appear in the urine when, under the influence of bacteria, protein substances undergo cleavage. Only a few members of this group are easily demonstrated chemically; these substances for which we look in the urine, if the above-described processes are suspected, all belong to the phenol and indoxyl groups. They occur constantly in the urine as conjugated sulphuric or glucuronic acids. The organism also excretes in this form a series of aromatic substances which have not originated within it, but have been introduced from without. On the administration of substances of the aromatic series, the sulphates disappear from the urine or are decreased to traces, while the conjugate ethereal sulphuric acids are present in large quantities.

Intestinal Putrefaction.—The most important source of aromatic substances is intestinal putrefaction. Also the tryptic digestion acts in this sense, the proteins being split up into the crystallized products, leucin and tyrosin, which on putrefaction produce phenol, skatol, and large quantities of indol, which latter substance is the mother substance of the urine indican.

In Constipation and Diarrhea.—A part of these substances in question leaves the organism with the feces, another part, very small under normal conditions, is resorbed and is excreted with the urine. From this it would follow that the indican content of the urine would increase in sluggish stools and that it would decrease in diarrhea; however, this is not always the case. Constipation is often associated with a urine excretion of indican not at all increased, and, on the other

hand, indican may be found in abundant quantities in diarrhea. Patients with intestinal atony may, as long as they are constipated, feel completely well even if they have no bowel movement for days. As soon as diarrheic stools appear their general fee ing is soon disturbed, they become prostrated, weak, and complain of headache and dizziness, loss of appetite, unrest, and a sensation of oppression. Bouchard explains this in the following way: The inspissation of the feces is a protective measure of the organism against intestinal autointoxication. On liquefaction of the contents resorption of the toxic products becomes more readily possible. Another explanation of the absence of indicanuria in uncomplicated cases of constipation is very obvious. The normal intestinal function, as is known, differs from intestinal atony by a paresis of the muscles of the large intestine. In simple constipation scybala are found in the rectum, sigmoid flexure, and in the intestine as far up as the cecum, but, as we know, stasis of the large intestine produces no increased indican excretion.

In Stenosis of the Large and Small Intestine.—This may best be seen in intestinal stenosis, which, in occlusion of the small intestine leads to indicanuria, but not in stenosis of the large intestine.

In Diffuse Peritonitis.—In diffuse, especially in the acute purulent peritonitis, indicanuria develops regularly, owing to the paralysis of the intestinal musculature, which produces a stagnation throughout the whole extent of the intestines. In coexisting peritonitis indicanuria due to a stenosis may be increased, and in stenosis of the large intestine it may develop as a secondary manifestation.

Influence of Bacterial Flora.—There exists a series of pathogenic microbes which are unable to produce the formation of indol or phenol. However, in infections with these bacteria, as in typhoid fever and streptococcus enteritis, intestinal putrefaction is, nevertheless, present, due to other ever-present microorganisms. It is different in an infection of the chyme leading to acid fermentation. When carbohydrate fermentation exists, the acidification of the culture medium is the cause of the suppression of the processes of putrefaction. Thus may be explained an interesting fact discovered by Bienstock. Increased putrefaction of albumin in the intestines of children is found more readily if they are fed with sterilized milk than with that not sterilized.

Indicanuria.—In Infants.—The test for indican in the urine of the healthy breast-fed child is constantly negative, whereas in bottle-fed children it is frequently positive, and in infants with gastrointestinal disorders constantly positive. The increase of indican and the intensity of the intestinal processes stand in a certain relation to each other. Atrophic infants show indicanuria, contrary to the opinion

of A. Mayer; the opinion that indicanuria is of semiotic significance in the tuberculosis of children cannot be accepted, though its frequent occurrence cannot be denied. The same behavior as that displayed by indoxyl sulphuric acid is also shown by the ethereal sulphuric acid, whose absolute daily quantities are normal in healthy breast-fed children: according to Freund, 0.0091 to 0.0162 gm. After the first year of life, when nourishment on a mixed diet has begun, the aromatic bodies in the urine of children behave like those in adults. Indol formation is absent in the intestine of the healthy breast-fed child, because casein is a substance which undergoes putrefaction only with difficulty.

In Putrid Infections Outside the Intestines.—Putrid bronchitis and pulmonary gangrene, as well as suppuration without putrid decomposition, may lead to indicanuria. In abscess formation of various kinds, as empyema, indican or phenol is found. Indicanuria is found also, though not completely understood, in febrile diseases, as angina, measles, scarlet fever, and erysipelas, sepsis and pulmonary tuberculosis. If we believe with Friedrich Müller that indol cannot be formed on the breaking down of the proteins of the tissues, and is only possible on *putrefaction* of the proteins there remains as explanation for these cases only the presence of a severe intestinal putrefaction which has developed together with the fever, unless in scarlet fever we have to deal with some necrotic rhinitis or a putrid exulcerating angina and in pulmonary tuberculosis with putrid contents in the cavities.

In Typhoid Fever.—Marked indicanuria in the course of typhoid fever is of unfavorable prognostic significance, provided it cannot be explained by coprostasis (A. F. Blumenthal). It signifies the immigration of putrefaction-producing microbes into the typhoid ulcerations or the entrance of an effusion of blood into the intestines, furnishing an excellent medium for decomposition processes.

In Intestinal Hemorrhage.—The same behavior is found in the intestinal hemorrhage of gastric and duodenal ulcers. Simon states that in stomach affections the quantity of indican excreted is inversely proportional to the secretion of gastric juice, except in gastric ulcer where increased indican is said to be the rule.

In Stomach Diseases.—Conclusions as to the secretory functions of the stomach drawn from the indican in the urine would be of value, as in the tendency to gastric hemorrhages, the use of the gastric tube is inadvisable, and indeed in gastric carcinoma, in dilatation of the stomach, and in ulcer, pronounced indicanuria has been observed. However, the semiotic significance of indicanuria cannot be estimated very highly, as in all consumptive diseases an increase of indican may be observed, a fact which is not in harmony with the theory of Friedrich

Müller that indol is exclusively formed from protein in a state of putrefaction.

In Blood Diseases, Especially in Chlorosis.—In constitutional diseases, as multiple lymphoma, leukemia, Addison's disease, and, above all, chlorosis, indican has been found increased in the urine. In the last condition its pathogenesis has for some time been connected with autointoxication. Some authors, among them Nothnagel and Bouchard, did not consider the intestinal atony as an associated symptom, but as the cause of chlorosis. The resorption of toxic substances was said to destroy hemoglobin or to influence hematopoiesis unfavorably. Bunge believes that H_2S is the noxa, injurious because of its power of forming the insoluble sulphide of iron. Other authors blamed other products of protein decomposition; the "urotoxic coefficient" was determined and the indican excretion examined, as well as the total quantity of ethereal sulphuric acid (indol, skatol, phenyl-sulphuric acid). Rethers, as well as v. Noorden, found no ground, from these examinations, for the opinion that chlorosis is an intestinal autointoxication. However, some cases of chlorosis show improvement if the intestinal putrefaction is decreased.

In Inanition.—The behavior of indican in the state of inanition is of interest. Salkowski observed in a starving dog, which had previously been nourished with meat, a considerable decrease in the indican excretion even in the first days. Also in human beings the indican excretion is completely absent on abstinence from food. Fr. Müller believes that the decreased indol production and the increased phenol production during inanition is due to an abnormal decomposition of proteins. v. Noorden believes that the increase in the aromatic bodies in the urine sometimes observed during inanition is of intestinal origin, and points out that it may be derived from the mucin of the bile. F. Blumenthal proved in anmals that the toxic decomposition of proteins may lead to indoxyluria without any involvement of the intestine, and therefore without bacterial interaction. This permits of another conception of indicanuria in consumptive diseases, fever, and ulcerative processes

In Kidney Diseases.—In renal affections, especially in purulent pyelonephritis and in the toxic nephritis due to pus foci in the organism, abundant indican may be found, indeed, occasionally on decomposition of the urine, true indigouria.

In Nervous and Mental Diseases.—It is further a frequent symptom in nervous and mental diseases. The indicanuria of neurasthenia results, probably, from intestinal atony and the resulting autointoxication. Doubtless there are many neurasthenias which develop on the ground of intestinal atony. Indoxyluria has been produced by puncture of the fourth ventricle in rabbits, and it has

been observed together with an increased excretion of urea, in mental diseases, as the expression of a breaking down of tissue, which also may be brought about by nervous processes. In the course of cerebrospinal meningitis, indicanuria has already been observed by Oppolzer.

Organ of Indoxyl Formation.—The organ which has the function of neutralizing the toxic decomposition products of the intestines is the liver. It also forms the conjugate etherea sulphuric acid by synthesis. Gilbert and his pupils see in the appearance of indoxyl in the urine without any other anomalies a sign of the insufficiency of the liver. Thus may be explained the common occurrence of glycosuria and indoxyluria, and, on the other hand, the appearance of indican in the urine in uric acid diathesis.

Decreased Indican in Pancreatic Affections.—Considering a decreased amount of indicanuria, we must say that under normal conditions this cannot be demonstrated, as the quantity of indican excreted physiologically is very slight. A decrease is only to be spoken of if one has cause to expect more indican than was in fact found (v. Leube).

If we consider the tryptic action of the pancreatic juice, it is readily understood that in the animal ligature of the duct of Wirsung lowers the indican content to one-fourth of the normal. In accord with this experiment is a case reported by Gerhardt of an ileus of the small intestine, in which the indicanuria, constantly present in this condition, was absent. The postmortem examination showed a hemorrhagic pancreatitis with obstruction of the duodenum; the total absence of indicanuria pointed, in this case, to the cessation of the function of the pancreas.

Action of Ethereal Sulphuric Acid.—For the relation of conjugated sulphuric acid to sulphate sulphuric acid no standard values can be given, even if a test diet were introduced, as the same food in different healthy individuals leads to an entirely different degree of intestinal putrefaction. It may be stated that, in general, the ethereal sulphuric acids decrease on a diet poor in proteins, reaching the lowest figures on milk diet. The antiputrid action of milk is, in the first place, due to the production of antifermentative acids, especially lactic acid. Gilbert and Domenici proved, further, that the number of microorganisms in the stools on milk diet sinks to the (1/70) seventieth part of the normal. Under pathological conditions, ethereal sulphuric acids go parallel with the indican excretion only in their quantitative relations. The maximum of indican excretion is found in the morning, that of ethereal sulphuric acids in the evening and at night. Like indicanuria, the excretion of conjugated sulphuric acids in typhoid fever may, by a sudden rise, indicate an unfavorable exacerbation, as, for instance, intestinal hemorrhage. The influence of

intestinal disinfectants on both substances is the same. On the administration of calomel or bismuth both sink until mere traces are found.

In the urine of the new-born indoxyl is never found, but slight quantities of ethereal sulphuric acids are, which, as the intestinal contents of the new-born are sterile, having been derived from the blood of the mother, have reached the circulation of the fetus through the placenta.

The determination of ethereal sulphuric acids is a finer reaction than that of indoxyl. If the indicanuria is very pronounced, it is not necessary to determine the ethereal sulphuric acids. If the indicanuria is only moderate, their quantitative determination is a valuable method of proving or excluding severe bacterial decomposition, whether in the intestine itself, in a perityphlitic abscess, or in empyema. The normal limit for adults in twenty-four hours is 0.4 gm.

Phenols.—The amount of cresol and phenol sulphuric acids does not go quite parallel with the indoxyl excretion. Thus in anemia the indican is increased, the phenol elimination decreased. The opposite relation holds in the state of inanition. In jaundice indoxyl and phenol sulphuric acids may be present in normal amounts, whereas the ethereal sulphuric acids are considerably increased.

Therapeutic Considerations.—Augmentation of the elimination of the aromatic substances in the urine has in general to be considered as an important prognostic and symptomatic factor, but, however, must not be combated in itself. In ileus, peritonitis, etc., the severe primary conditions so occupy the foreground that the indicanuria furnishes no special indication for therapeutical measures. It is only in the slighter disturbances of the gastrointestinal tract in enterogenous intoxications that the demonstration of pathologically changed products of decomposition deserve greater interest, and, in the absence of other objective criteria, the effect of our treatment may be controlled by the urinary findings. This is the more desirable in patients suffering from intestinal autointoxication as they are neurasthenics and apt to exaggerate their ailments.

In the choice of the diet carbohydrates have to prevail over the proteins. Dujardin-Beaumetz prefers the vegetable diet. Rosenheim gives the following bill of fare:

7:30 A.M. 1 glass cold water.

8:00 A.M. 200 gm. of coffee with sugar and milk, 20 gm. butter, 100 gm. whole wheat bread.

10:00 A.M. 300 gm. buttermilk.

12:00 M. 200 gm. bouillon, 200 gm. roast meat, 250 gm. vegetables, 100 gm. compote, 300 gm. white wine.

2:00 P.M. 1 cup coffee.

4:00 P.M. 300 gm. kephyr, 50 gm. bread.
7:00 P.M. 120 gm. meat, 30 gm. butter, 200 gm. bread, some fruit.
9:00 P.M. 1 glass beer.

In obstinate chronic cases, massage, gymnastics, faradization of the abdominal walls, cold douches on the abdomen, and cold half-baths of short duration will be indicated.

The best disinfection of the intestines consists in the regular emptying of the bowels, which must be accomplished in acute constipation by means of a laxative; in chronic, by mechanotherapy, and in inflammatory changes in the intestine by irrigation.

Of medicaments, a series of approved antifermentatives is at our disposal. First of all, creosote in doses of 0.05 gm. three times a day, together with 0.2 gm. ol. amygdalarum in capsule towards the end of the meal; or, if we wish it to work on the lower parts of the intestine, it may be given in the form of keratin pills whose external coating is only broken up in the alkaline intestinal juice. Patients who are not able to swallow pills or capsules may take a teaspoonful at meal time of 1 gm. creosote to 100 gm. brandy. Creosote carbonate, ammonium sulpho-ichthyolate, guaiacol and guaiacol carbonate, and menthol may be tried with similar results.

The dose of these drugs varies between 0.1 and 0.2 gm. Bouchard recommends:

Rp. β-Napthal pulv., 15.0
Bismut. salicyl.,
Natr. hydrocarbon., āā 7.5
M. f. pulv. Div. in dos. æq. Nr. XXX.
DS. Three powders daily.

Hayem calls attention to the fact that β-naphthol increases the HCl secretion and is therefore contraindicated in hypersecretion. Yvon and Berlioz recommend as intestinal antiseptics the benzo-naphthol, which in the intestine is split up into benzoic acid and naphthol, both substances acting antifermentatively.

Huchard prescribes:

Rp. Benzonaphtholi, 5.0
Carbonis depur., 3.0
Pankreatin, 1.0
Div. in dos. æq. Nr. X.
DS. Four to six powders daily.

Children tolerate benzo-naphthol very well in doses of 0.1 to 0.2 gm. Also lactic acid, in doses of half a wineglassful of a 5 to 7 per cent. solution at meal times, or HCl, in doses of 10 drops to 4 tablespoonfuls of water, is of good service. Resorcin, in tablespoonful doses of a 2 per cent. solution, or in chloroform water, is of similar action.

H. LEUCIN AND TYROSIN

Leucin and tyrosin appear in the urine in diseases in which body tissue is breaking down. Frerichs showed that it occurred in acute yellow atrophy of the liver and that it is found in the urine in a preformed state, and is not due to decomposition of the urine. Frerichs and Städeler proved further, in the same disease, the presence of these amino acids in the liver, and Jacoby in the aseptic autodigestion of the same organ. The fact that autolysis after phosphorus intoxication shows a considerable amount of leucin and tyrosin, explains the occurrence of these substances in this intoxication by the breaking down of liver tissue. Statements as to the occurrence of leucin and tyrosin in severe infectious diseases, such as typhoid fever and small-pox, are as dubious as the resorption of the amino acids from the intestinal canal, where they originate under the influence of the pancreatic digestion and of putrefaction.

I. THE DIAZO-REACTION

Ehrlich, the discoverer of the diazo-reaction, has presented its diagnostic and prognostic significance in the following way:

In typhoid fever the diazo-reaction is positive from the middle of the first week so regularly that its absence speaks against the diagnosis. Its slight intensity and rapid disappearance is of favorable prognostic significance. In measles it is constantly found occurring at the onset of the eruption; it is found, further, in scarlatina-diphtheria, but never in true diphtheria and pneumonia, so that with positive diazo-reaction in the course of these two diseases complications must be thought of. In pulmonary phthisis and tuberculosis of the serous membranes it indicates a rapid and unfavorable course, but the absence of the reaction signifies nothing. In septicemia it is rarely absent, and in severe erysipelas almost never.

The importance of the diazo-reaction is considered very little by some, whereas others maintain its diagnostic value. In an acute exanthem a positive diazo-reaction at any rate speaks for an infectious, rather than for a toxic origin. It is found in 80 per cent. of measles; but is absent in rubella, in vaccination, and medicinal exanthems. If positive, it speaks for scarlet fever and against toxic erythema, though it is found by no means so frequently in scarlet fever as in measles.

This reaction is of great prognostic value in typhoid fever. Even after defervescence it may persist if the infectious process in the intestine has not completely passed. In the convalescence of typhoid, rises in temperature from slight causes, as constipation, mental excitement, etc., are frequent. The reappearance of the diazo-

reaction, is a sign that we do not have to deal with a transient insignificant rise of temperature, but with the onset of a true relapse.

In regard to tuberculosis, the frequent presence of the reaction in basilar meningitis and acute miliary tuberculosis is beyond doubt. Also tubercular pleurisy, if of a chronic course, tends to the diazo-reaction. In chronic, as well as in initial phthisis, it is a symptom to be taken seriously if no other intercurrent disease can be found as its cause. But the diazo-reaction may disappear and the pulmonary processes again improve. In Koch's institute, cases with the positive diazo-reaction are refused tuberculin treatment, which shows the great significance attached to this reaction. It is important to know that the diazo-reaction may be simulated by opium, morphin, etc., and that its appearance is hindered by phenol derivatives, creosote, and tannin preparations. Thus tubercular patients who have taken creosote may show no diazo-reaction.

J. URIC ACID

Our conception of the rôle which uric acid plays in the organism has undergone very many changes and is by no means completely settled.

The Normal Uric Acid Metabolism.—The uric acid metabolism is entirely independent of the nitrogen metabolism. Since the fundamental investigations of Horbaczewski, it has more and more become a certainty that in the mammalian organism uric acid develops for most part by oxidation of the nuclein bodies of the food and of the body substance.

Formation of Uric Acid.—By digestion of organ parenchyma, without access of air, Horbaczewski obtained traces of xanthin, but in the presence of air uric acid. By feeding patients with glands rich in nucleins, like the thymus, a considerable increase of the uric acid in the urine was obtained by Weintraud. The formation of uric acid from simple protein bodies is not excluded, though the administration of nuclein-free protein increases the elimination of N without augmenting the quantity of uric acid. The proportion of urea N to uric acid N, which, on mixed diet, was believed to be 1:0.4 to 0.7, and formerly played a great rôle in the pathology of metabolism, is at present not of much interest, as we know that, even under normal conditions, it may vary between wide limits and, further, that we have to deal with two values entirely independent of each other.

The relation of the uric acid to the form of diet has gained much in importance, for a great part of the uric acid is exogenous in origin, being derived from the preformed nuclein bases and nucleoproteids of the food, which in certain organs, as the thymus, are present in

great abundance and which also occur in the common meats in no inconsiderable quantity. The vegetable diet, though poor in uric-acid-forming substances, is not completely free from them.

100 gm. fresh thymus contains 0.429 to 0.482 gm. purin N.
100 gm. fresh beef contains 0.055 to 0.071 gm. purin N.
100 gm. fresh milk contains 0.0004 to 0.0006 gm. purin N.
100 gm. potatoes contain 0.0005 to 0.0006 gm. purin N.
100 gm. black bread contains 0.00001 gm. purin N.

Another source of uric acid is furnished by the nuclein bodies of the organism—"endogenous uric acid." Its existence is proved by its excretion during absolute fasting and by the elimination of uric acid, up to 0.1 gm. *pro die*, in infants who in milk receive a very inconsiderable amount of uric acid.

Excretion.—The elimination of endogenous uric acid may be approximately determined by placing an individual on a milk and vegetable diet; in this way great individual variations will be found, for not only must the nucleoproteids be considered as the source of the endogenous uric acid, by whose decomposition a daily elimination of 0.3 to 0.6 gm. is obtained, but it originates in the muscles from purin bases, like hypoxanthin (Burian and Schur). According to these authors, under normal conditions only half of the uric acid formed leaves the organism as such. The following are the standard values for the uric acid excretion given by Magnus Levy:

On vegetable and purin-free diet, about	0.25 to 0.6 gm.
On mixed diet,	0.5 to 1.0 gm.
On meat diet principally,	1 to 1.5 gm.

600 gm. meat = 809 mg. uric acid.
1650 gm. meat = 1230 mg. uric acid

Increased Uric Acid Excretion.—The following are causes of an increased elimination of uric acid:

1. A too abundant supply of purin bodies.
2. An increased decomposition of nuclein bodies in the organism.
3. A decreased capability of burning up the uric acid.
4. The excretion of uric acid which has been retained.
5. Uric acid synthesis.

2. An increased decomposition of nuclein substances occurs in leukemia. The elimination of uric acid amounts to twice the normal, up to 5 gm. daily. The uric acid may be a product of the leukocytes or may develop only on their breaking down. This latter factor has been proved for acute leukemia.

The increase in the production of endogenous uric acid cannot a'ways be explained by a hyperleukocytosis. It is derived partly, perhaps, from the free purin bases of the organism. In pseudoleuke-

mia uric acid is not increased; in pernicious anemia, however, it increases.

3. In liver cirrhosis and other severe affections of the liver, the urea-forming function of the organ may be much impaired, resulting in an increased elimination of uric acid. Thus Bouchard found a daily uric acid elimination of 8 gm. in cirrhosis of the liver. A decreased elimination of uric acid is found in pyuria, lead poisoning, and under the influence of drugs, as quinin, alkaline bicarbonates, and lithium salts.

If uric acid is incorporated into the body, it is excreted as urea (Wöhler and Frerichs). Introduced per os into human bodies, it causes no increased uric acid elimination, but only urea. This does not prove that disorders of oxidation lead to an increased production of uric acid nor, inversely, that disorders of the uric acid excretion stand in any connection with a disturbed oxidation.

4. Retention of, and the resulting increased elimination of, uric acid do not play a great part in healthy individuals, but this condition is not rare in the uric acid diathesis.

5. In birds and reptiles, which give off their nitrogen for the most part in the form of uric acid, it is formed by synthetic processes, whereas in man and other mammalia this possibility deserves only very limited consideration.

Gout.—According to the present idea concerning the uric acid diathesis, the statement of Garrod, that in this condition the elimination of uric acid is diminished by its retention, has to be abandoned.

Uric Acid Content of the Urine in Gout.—According to the newest reliable investigations, no characteristic regularity in the uric acid excretion exists in gout, either in the periods free from attacks or in the chronic form. Before an acute attack the uric acid in the urine is constantly decreased; during and after the attack, constantly increased. Beside the high uric acid content of the blood and its insufficient elimination, the poor oxidation of the tissues becomes an important factor in its deposition in them. The uric acid excretion is of course intimately related to the kind of nourishment.

In chronic gout, without pain in the joints and without gouty kidney, there is no deviation from the normal if the diet is free from meat, whereas retention becomes manifest if meat is eaten. Also in the acute attack of gout an abnormal elimination of uric acid is only to be observed on the addition of meat to the diet, the usually marked increase remaining absent on a vegetable diet.

Uric Acid Content of the Blood.—There is no doubt that there exists an accumulation of uric acid in the blood, which Garrod proved by means of his thread experiment. However, the explana-

tion of this fact is not simple. Retention of uric acid by an injured function of the kidney, increased production of uric acid from an abnormally high nuclein metabolism, and a lowered oxidation of the uric acid have to be considered. An increased uric acid content in the blood is found in other diseases, as leukemia, renal insufficiency, pneumonia, and on a diet with too great a supply of uric-acid-forming substances (sweetbreads); in these conditions there are no uric acid depositions. We are, therefore, not justified in accepting Garrod's explanation of the attacks of gout, that they are due to an oversaturation of the blood with uric acid, the less as no differences are observed in the blood during and after an attack.

Diagnosis of Gout.—The diagnosis of gout is generally made by the nature of the attack, the gouty deposits (tophi), and the presence of the gouty deposition, in which heredity, lead intoxication, and mode of life are important factors. Garrod's thread reaction may be used to test an increased amount of uric acid in the blood. If the test is positive it points to gout, provided that the other conditions leading to the same changes can be excluded. The examination of the uric acid content of the urine is in no case decisive for the diagnosis.

Uric Acid Excretion in the New-born and in Children.—The excretion of uric acid in the first days after birth is quite constant, varying between a daily amount of 40 to 80 mg. Children above one year show a variable excretion in uric acid, so that no standard values can be given. On a mixed diet, one finds about 0.1 to 0.2 gm. *pro die* in children of one to two years, and 0.2 to 0.4 gm. between the ages of two and five. These figures increase considerably after puberty.

In comparing the uric acid coefficients at the different periods of life we find that infants excrete about 1 per cent. of the total N in the form of uric acid, older children somewhat more, and adolescents 1 1/2 per cent.

Uric Acid Infarct.—In the first days of life the urine shows a brick-red sediment, consisting of ammonium urates. It is due to the elimination of a uric acid infarct. Conditions of irritation in the urinary passages, as the retention of urine and pain on urination, may be due to the excess of uric acid.

The elimination of uric acid concrements in the form of gravel may produce eclamptic attacks in small children and, sometimes, conditions resembling the renal colic of adults.

K. URINARY PIGMENTS

The elimination of the normal urinary pigment to a certain degree indicates the functional capability of the renal parenchyma, whose function it is to form it from the blood pigment. In estimating the

quantity of urinary pigment, the specific gravity of the urine must be taken into consideration.

Urobilin.—Urobilin, discovered by Jaffé and recognized as a reduction product of bilirubin by Maly, occurs under various pathological conditions. The coloring matter of the feces (stercobilin) found below the ileocecal valve has the same composition as the urobilin of the urine. MacMunn believes that the urobilin in the urine of febrile patients is different from that of normal urine and that it is not identical with hydrobilirubin. Other authors distinguish a physiological urobilin due to oxidation, and a pathological form due to reduction, of the biliary pigments.

Ways of Urobilin Formation.—It is generally accepted that urobilin is formed from the bilirubin in the intestine. Vaughan Harley thinks it may be formed in the body tissues and in the renal tissue by reduction. In liver insufficiency urobilin is said to be formed in the liver, instead of bilirubin; and also in the circulation in destruction of the red blood-corpuscles.

Urobilin Formed from the Blood Pigment.—From oxyhemoglobin the hematin is derived; and from the hemoglobin the reduced hematin. From hematin is derived the iron-free hematoporphyrin, which is readily transformed into isomeric bilirubin.

In Intestinal Putrefaction.—In putrefaction, with which reduction processes are associated, urobilin is formed from bilirubin. As long as putrefaction is absent from the intestines, no urobilin is formed in the urine. It fails in the urine of the new-born because the meconium is free from microorganisms; and, if we disregard traces, it is not found in the urine of breast-fed children, whereas it is found in slight quantities in artificially fed infants.

Urobilin-icterus.—Urobilinuria is occasionally associated with jaundice. This "urobilin-icterus," discovered by D. Gerhardt, is explained by Leube in this way: the yellow discoloration of the skin is produced by the biliary pigments; the urobilin appears in the urine by the transformation of bilirubin in the kidneys. At the same time urobilin may be found in the blood.

Occurrence in Diseases.—Urobilinuria has been found in biliary stasis if the bile still reaches the intestines; in coprostasis, internal hemorrhages, in afebrile diseases, especially in pyemia, malaria, pneumonia, perityphlitis, scarlet fever, and in constitutional diseases, as scurvy, Addison's disease, and chlorosis, in hemoglobinemia of slight degree, and in carcinoma.

The occurrence of urobilin in the urine of infants suffering from pneumonia is still unexplained, as otherwise the urine is completely free from urobilin, intestinal putrefaction being absent in infants. The absence of urobilinuria in certain blood diseases is interesting, as

in anemia, leukemia, and pseudoleukemia, and in diphtheria and severe kidney diseases, in which the permeability of the kidneys to urobilin is perhaps lost (Achard and Morfaux); also in those in which no bile passes into the intestines, as in occlusion of the common bile duct, acute yellow atrophy of the liver, and in phosphorus intoxication.

Beside the enterogenous urobilinuria, there is a toxic form, produced by blood poisons, found thus after chloroform anesthesia, tuberculin injections, antipyrin, the administrat on of antifebrin, etc.

Liver Diseases.—Urobilinuria is frequently found in carcinoma of the liver and in cancer of other organs. The behavior of urobilin in jaundice is very complicated; if a slight degree of jaundice exists, it is usually much increased, but if the stoppage of the bile is complete, it is absent, as, though the intestinal putrefaction is high, its mother substance, bilirubin, is wanting. If bile again reaches the intestines, an abundant formation and excretion, of urobilin results. In this way, recovery from jaundice is often associated with urobilinuria. In fever, urobilin may be excreted, though there is an absolute stoppage of bile, which proves the formation of urobilin outside the intestine from destruction of the red corpuscles. In simple atrophy of the liver and in amyloid liver, the urobilin content of the urine is found to be diminished in proportion to the lowered production of bile.

In the atrophic cirrhosis of the liver the urobilin is considerably increased in the urine. V. Noorden explains this by the abundant production of bile, whereas Quincke blames abnormal resorption and other pathological conditions.

Bile Pigments.—That bile pigments do occur in the urine may merely be mentioned here, as the symptom-complex of jaundice is treated in a special chapter.

Hematoporphyrin.—The excretion of hematoporphyrin has been discussed in connection with hemoglobinuria.

Melanin.—The urine of patients suffering from melanotic tumors (melanosarcoma) shows not seldom a dark discoloration, or becomes dark from oxidation on standing. In the first case meianin is pre ent; in the latter, its chromogen, which is transformed into meianin spontaneously or by means of an oxidizing agent (ferric chlorid, v. Jaksch). The latter test will prevent confusion with phenol and indoxyl urines, though a possible connection between melanin and indoxyl cannot be denied.

Melanuria is explained by resorption of the pigment from the tumor, and its reduction to melanogen in the blood. As melanotic tumors are especially malignant, melanuria is an extremely unfavorable symptom.

CHAPTER XVII

SEVERE GENERAL INFECTIONS

DEFINITION

In the clinical sense of the word, an infectious disease is caused by the entrance into the human body of a living microorganism, capable of reproduction. Experimentally, infections may be produced by the introduction of the metabolic products of bacteria, but this never occurs during life as the bacterial toxins are not present in such quantities that they may cause morbid manifestations identical with those produced by the bacilli themselves.

INCUBATION

The time which intervenes between the entrance of the microorganism into the living tissue and the appearance of the first manifestations of disease is known as the period of incubation. The number of invading microbes and the point of invasion determine its duration. Thus the incubation period of tetanus is shorter when the portal of entrance is the skull than if it is the toe, because only the central nervous system possesses any affinity for the toxins. The disease develops most rapidly when the microbes enter the circulation directly. The period of incubation allows a conclusion as to the severity of the case in those infectious diseases in which it is subject to variations; thus those cases of tetanus which break out within ten days of the injury will certainly be severe. In some streptococcic infections a very short incubation period, twenty-four hours, speaks for the high virulence of the microbe.

There is a series of diseases in which this relation between incubation and severity of the disease cannot be demonstrated. The incubation in bacterial toxicoses (tetanus, diphtheria, etc.) is not only dependent on the gradual production of toxins, but also on their gradual fixation by the organs sensitive to them. This may be seen from the experiment that the incorporation of maximal doses of toxins may shorten the period of incubation, but never reduce it to zero.

In the infections proper (malaria, anthrax, septic processes, and typhoid) the latent stage is probably due rather to the fact that the

microbes, having penetrated in small numbers, must multiply to a certain degree before the disease phenomena can arise.

In recent times, v. Pirquet and Schick have tried to explain incubation from another point of view. They believe that the time of appearance of the clinical symptoms depends on the reaction between the metabolic products of bacteria and the antibodies which the organism is able, only after a certain length of time, to produce. Since the immune organism produces antibodies faster, the incubation, on repeated infections with the same agent, would be shortened, according to this theory. That this is in fact the case, v. Pirquet and Schick showed on revaccination. The latent period of some of the common infectious diseases is as follows:

Measles, until the prodromal stage, ten to eleven days.

Measles, until the outbreak of the exanthem, thirteen days.

Scarlet fever, one to four days.

Rubella, fourteen to twenty days.

Varicella, usually fourteen days.

Variola, ten to thirteen days,

Vaccination, three days,

Pertussis, two to eight days.

Typhoid, two weeks or longer.

Exanthematic typhoid, usually eight to twelve days.

Relapsing typhoid, five to seven days.

Diphtheria, two to five days.

Malaria, usually six to fourteen days, according to some authors from a few hours to months.

Syphilis (until the primary lesion), two to four weeks.

Soft chancre, twelve to twenty-four hours.

Gonorrhea, two to three days.

Erysipelas, seven to seventy-two hours, on experimental transmission (Roger).

ACTION OF BACTERIA IN THE ORGANISM, DURING THE COURSE OF INFECTION

The spreading of bacteria in the course of a disease depends on their biological properties. Exceptions from the general rule are not rarely found, however.

1. Saprophytes do not penetrate into living tissue; it is only by the resorption of their putrefaction products from necrotic tissue, cystic fluids, and the intestinal contents (botulism) that sapremia arises. This condition may be very severe and even fatal; in general, however, the prognosis is favorable if the putrid products are removed in time. Defervescence may follow their removal, after a few hours.

2. The bacteria may propagate only at the point of entry; in tetanus this behavior occurs regularly, whereas in other infections it represents a specially favorable course (local tuberculosis of the skin or mucosa, abscess formation by pyogenic cocci, definitely localized diphtheria).

3. Extension by contiguity is seen chiefly in erysipelas, phlegmonous processes, wandering pneumonia, in the catarrhal inflammation which descends from the nasal cavity into the finest bronchi or ascends from the urethra into the renal pelvis, and in creeping diphtheria.

4. Of special importance and danger is the formation of metastases. Whereas purulent meningitis develops only gradually from a pus focus in the region of the head by direct extension, a furuncle on the lips or at the anal orifice may cause its appearance by the formation of a metastasis. To this process is due the appearance of tubercular meningitis in the course of a chronic tuberculosis of the bones or bronchial glands, of a purulent meningitis after a diplococcus infection of lungs and pleura. It is a peculiarity of the child's organism that metastases from thoracic affections into the brain occur much more easily than in adults. Acute general miliary tuberculosis and pyemia are due to multiple metastases. Injuries have a decisive effect on the localization of metastases; and in this way osteomyelitis or a fungus may be spread.

5. Whereas in metastasis formation the microorganisms are found in the blood only at the moment of transport, there are other diseases where they are constantly present in the blood and even propagate there. Here belong not only the true septicemic affections, due to staphylo-, strepto-, diplococci, etc., but also malaria and relapsing fever, diseases which to-day should be diagnosed only after examination of the blood. The bacilli of typhoid and paratyphoid fever, too, penetrate into the circulation, where they may be demonstrated in the first days of the disease, at a time when the clinical examination and the agglutination give nothing decisive for the diagnosis. Bacteremia occasionally occurs in infections which, as a rule, do not spread by the blood, as in gonorrhea leading to endocarditis, in cerebrospinal meningitis, diphtheria, etc.

COURSE OF INFECTION

Several factors are decisive for the gravity and duration of an infectious disease.

1. The quantity of the pathogenic germs introduced.

2. Their virulence, a factor not to be exactly defined as yet, which is expressed in the "genius epidemicus."

3. The disposition of the host. Thus there is often a very similar course in an infectious disease in the members of the same family.

4. The place of entry. Fresh wound surfaces are favorable ground for rapid resorption, granulating surfaces much more unfavorable. Thus septicemia takes an especially severe course if it spreads from the wounded surfaces of the puerperal uterus.

5. A mixed and secondary infection are of the greatest importance in an infectious disease. Thus, for instance, a chronic pulmonary tuberculosis of a benign course, which for years scarcely makes any progress, may, within a few weeks, be changed into the typical consumption recognizable even by the laity.

LOCAL EFFECT OF THE GERMS OF INFECTION

The pathogenic organisms generally arouse an inflammation at the point of entrance, the character and course of which points to the nature of the infection. Thus the bacillus of diphtheria, the bacillus of anthrax, of glanders, of tuberculosis, and the spirocheta of syphilis have a certain specific local action. It is just the opposite in cryptogenetic infections, in which the lesion, which served as port of entry, heals very soon, and is therefore not to be found at all. This is the case in many streptococcus septicemias. The involvement of the glands sometimes points to the region of infection, as in bubonic plague.

Mode of Infection in Tuberculosis.—It is entirely unknown, in most cases, how the tubercle bacillus acts in this regard, and the pathogenesis of tuberculosis is by no means clear. Until a few years ago, inhalation was regarded as the only source of infection in pulmonary tuberculosis. Even in those cases where the lung parenchyma was normal, and the hilus glands alone were involved, the infection was explained by a transmigration of the tubercle bacilli through the alveolar walls without injuring them.

In 1903 Behring again pointed out the possibility of the transmission of tuberculosis by food; thus tuberculosis having attacked the organism in earliest childhood, becomes manifest in late years. In fact, primary intestinal and mesenteric glandular tuberculosis is not rarely found in infants—in about 30.7 per cent. of all postmortem cases of tuberculosis in children. It is possible that the primary tubercle focus is in the intestinal mucosa, which is permeable for the tubercle bacilli, either in the normal condition or after having acquired this property from injury by other nontubercular processes.

Prognostic Significance of Local Reaction.—The local reaction generally depends on the virulence of the infecting agent, and on the capability of reaction on the part of the individual. Streptococcic infections of the puerperal uterus lead to infiltration and to endo- and perimetritis, but those forms are the most fatal which present no

inflammatory wall. "Thus we see in guinea-pigs that have obtained a certain degree of immunity by means of antitoxin, but not complete protection against diphtheria, under the influence of the diphtheria toxin an extensive local inflammation develop at the point of injection which, with demarcation, leads to necrosis of part of the tissue, but the animal remains alive. A normal guinea-pig, with the same dose of diphtheria toxin, shows scarcely any local reaction at the point of injection, but quickly succumbs to the general effects of the poison. The stronger local reaction is only an expression of the general immunity." (Wassermann).

GENERAL SYMPTOMS IN INFECTIOUS DISEASES

The general effects of pathogenic microorganisms are dependent, for the most part, on the resorption of their toxins into the circulation. This is best proved in diphtheria and tetanus in which the blood of the patient usually contains enough toxin to give the characteristic reaction in animals. In the other infectious diseases the amount of toxin contained in the blood is too small to be demonstrated by animal experiment.

Urotoxic Coefficient of Bouchard.—Bouchard and his school placed great value on the toxicity of the urine in infectious diseases, and expressed the relation of the toxic action of pathological and of normal urine, measured on mice and rabbits, as the "urotoxic coefficient."

Fever; Leukocytes.—Of special significance in the picture of infectious diseases are fever and leukocytosis, symptoms which have been considered previously.

Effusions into Serous Cavities.—Effusions into serous cavities may be considered as a general effect of infection if they are free from germs. There is not much known about them clinically, but, according to the findings of experimental pathology, this toxic origin of effusion must be conceded. Guinea-pigs are often affected with pleurisy after the subcutaneous injection of diphtheria toxin.

Convulsions.—To general manifestations belong the convulsions (in tetanus) and the other symptoms on the part of the central nervous system, without direct involvement of the brain and meninges. Especially in early childhood, various acute infections set in with convulsions due to the irritation of the motor cortical centers, which are of no more serious significance than the initial chill in croupous pneumonia.

Hemoglobin Content.—The drop in hemoglobin cannot be explained by the disturbed nutrition. In malaria it is sufficiently explained by the invasion of the parasites into the red blood-corpuscles. In other infectious processes we must think of the action of toxins,

which has been proved experimentally by the demonstration of hemolysins and hemagglutinins.

Hemorrhagic Diathesis.—A certain tendency to cutaneous and other hemorrhages is found in many infectious diseases, and is especially ominous in streptococcic diseases.

Enlargement of the Spleen.—In intimate connection with changes in the blood is a symptom which is met with regularly in many diseases, the enlargement of the spleen. This points to the fact that the oligocythemia is not due to an insufficient hematopoiesis, but to an increased breaking down of red blood-corpuscles. The acute splenic tumor is a typical finding in malaria, in which it augments gradually with each attack; also, in typhoid fever, relapsing fever, certain forms of jaundice, in a less number of cases of septicemia, erysipelas, angina follicularis, and influenza.

Other Parenchymatous Organs.—At postmortem one finds, almost regularly, a parenchymatous, and on longer duration of the disease a fatty degeneration of the liver, kidneys, and cardiac muscle. Also the nephritis of scarlatina has to be considered as due to toxin action, and therefore the attempt to prevent its development by the use of urinary disinfectants, as urotropin, has proved useless.

Postinfectious Affections of the Nervous System.—Nervous manifestations of various kinds make their appearance, due to the harmful effect of the metabolic products of the bacteria on the nervous elements. Though the paresis of the soft palate in diphtheria may be considered as a local action of the toxin, this view is certainly not possible in the fully developed multiple postdiphtheric neuritis, which clinically consists in atactic disorders in the extremities, in a nasal voice, paralysis of deglutition, of the glottis, and of accommodation. Other nervous diseases are very frequent during the course, and as sequelæ of infectious diseases, thus myelitis and the parasyphilitic diseases (tabes and progressive paralysis), and finally a series of neuroses. On the other hand, it is remarkable that preexisting hysterical symptoms often disappear in acute diseases; this may be explained purely psychically as distraction of the attention.

Influence of Infections on the Secretions.—The metabolic products of bacteria exert their action on the glandular activity also. The secretions of saliva and sweat often suffer markedly, but an excessive increase may be observed in the sweat secretion. Here belong the sweats of the critical drops in fever and of tubercular, septic, and rheumatic patients. Certain qualitative differences exist; thus the sweat of polyarthritis has an intensely sour smell. Cadiot and Roger have studied the action of toxins on the sweat secretion. Mallein produces sweats in horses, a few minutes after injection, by the direct irritation of the sweat center, not of the peripheral nerve ends. Whereas

the action of pilocarpin continues unchanged after the section of the sciatic nerve, mallein does not act after the nerve section. Tuberculin has no sudorific action.

MIXED AND SECONDARY INFECTION

It was formerly believed that the symbiosis of two kinds of bacteria was necessary to produce an infectious disease (Nägeli's diblastic theory). To-day we know that every bacterial disease is due to one specific agent. Still there are bacilli which alone cannot produce disease. The tetanus bacillus of itself can neither produce the disease experimentally in the animal nor the natural infection in man. It needs a hematoma or foreign body, or pyogenic cocci in its immediate neighborhood. Bacteria in pure culture may be expected only where the microbes of the air do not have access. In the bronchial or intestinal mucous membrane, beside the pathogenic organism, all the other common inhabitants of mucous surfaces are to be found. (Nevertheless, in severe intestinal infection (cholera, dysentery) the normal bacillus coli communis may be almost entirely crowded out by the pathogenic organisms.) This symbiosis is not a mixed infection; in the sputum one pathogenic species is never found alone. If the symbiosis is to have an influence on the disease, the associated bacteria must also be found in the tissues. We distinguish a mixed infection, in which the invasion of another kind of bacteria occurs at the same time, and a secondary infection, in which it occurs later. To mixed infections belong the participation of bacteria which previously were present at the point of infection and which, becoming virulent through the disease, complicate the condition.

In any tonsillar diphtheria those streptococci participate which were present in the lacunæ; in intestinal processes, the B. coli; in influenza of the respiratory organs, the diplococcus of pneumonia and the streptococcus.

Secondary infections occur in all diseases which lead to defects in the epithelium, destroying in this way the protection against bacterial invasion; thus in smallpox, diphtheria, dysentery, cholera, typhoid fever, and tuberculosis. Every severe morbid process lowers the natural protective powers of the organism, and thus opens the door to infection; for example, pneumonia in the course of measles, scarlatina, and typhoid fever.

Of great importance is the demonstration of mixed infection in the sputum of tubercular patients. Beside the tubercular bacilli, cocci of various kinds are found constantly, and it becomes necessary to know their significance. The virulence of the cocci may be tested on animals after they have been obtained in pure culture. Spengler

recommended washing the flakes of sputum by the method of Koch and Kitasato. If the cocci remain inseparable from the bacilli, after this procedure, it proves a mixed infection. Otherwise there exists an accompanying bronchitis, a concomitant infection of a much more favorable prognosis.

Bacteria may act on each other antagonistically. Some, as the diphtheria bacilli, produce a substance which has an agglutinating, lytic, and toxic action on other bacteria. There exists an antagonism between anthrax bacilli and erysipelas streptococci; a product of the B. pyocyaneus, pyocyanase, is a potent bactericidal substance, which has been used therapeutically.

In many diseases a secondary infection has a fatal significance, especially that with streptococci in diphtheria, scarlet fever, smallpox, tuberculosis, and plague.

There are four theoretical possibilities concerning the *spreading of mixed infection in the organism*, all of which may occur in reality:

1. Both forms remain strictly localized (certain pus cocci, tubercular infections).

2. Both kinds form metastases together. Streptococci are often found in metastatic focci with diphtheria, typhoid, and tubercle bacilli.

3. Only the secondary bacteria form metastases; a metastatic putrefaction, entirely due to cocci, may follow typhoid fever, diphtheria, or tuberculosis. Tubercular patients may suffer from a pure coccic pyemia or influenza pneumonia.

4. Only the primary microorganism forms metastases; after an influenza-diplococcus pneumonia, a pure influenza-meningitis may occur.

Six different groups of *bacteria* which may be associated in symbiosis are distinguished by Wassermann:

1. Different varieties of the same species are often found together, thus the staphylococcus pyogenes aureus, citreus, and albus.

2. Certain mixed infections occur regularly, as diphtheria bacilli and streptococci, or tetanus bacilli and pus cocci.

3. Streptococci are associated with staphylococci or with diplococci.

4. Streptococcus infections are frequently associated with typhoid fever, cholera, smallpox, plague, measles, and scarlet fever; the pneumococcus, Friedländer's bacillus, and the influenza bacillus with tuberculosis.

5. Anaerobic, putrefactive bacteria in necrotic inflammations, with various pathogenic microorganisms.

6. The aspergillus in tuberculosis of the lungs. The dysentery bacillus with the dysentery ameba.

Mixed infection, in general, renders the prognosis of the primary

disease much more grave. Some authors believe that two clinical pictures are associated, without the virulence of the two microorganisms being increased, as Wassermann found in the combination of typhoid bacilli and streptococci. On the other hand, it is frequently observed that in phthisical patients, who acquire a secondary infection, the tubercle bacilli become more virulent, and a miliary dissemination ends life. The hectic fever of phthisical patients is, too, the effect of streptococci or of their toxins. It is generally the rule that streptococci are much more dangerous in mixed infection than staphylococci.

Patients who have borne the primary disease well, whether typhoid fever, scarlet fever or diphtheria, sometimes succumb to a secondary streptococcic infection. The prognosis of diphtheria is sometimes obscured by a secondary infection, as the effect of the antitoxin, which acts only on the toxins of the Löffler bacillus, becomes doubtful. The duration of a mixed infection varies. It may last only a few days, but also for months. Especially in tuberculosis, the secondary infection with streptococci, as well as with influenza bacilli, may be demonstrated in the sputum for a long time. Still, a pronounced mixed infection in tuberculosis may terminate favorably.

General Treatment of Infectious Diseases

We are in possession of three remedies which have a specific action in treatment of infectious diseases. We recognize quinin as the sovereign remedy in malaria, the salicylate preparations in rheumatic polyarthritis, and the mercury and iodin preparations in syphilis. Since we know the specific agents in many diseases, by imitating the natural protective and curative powers, we endeavor to immunize against infections and to cure them when the morbid manifestations have appeared. Whereas immunization, that is, the preventive treatment, has been crowned with success in many diseases, as smallpox, tetanus, hydrophobia, and diphtheria, the problem of the etiological therapy, to cure diseases by bacterial antibodies after they have developed, has been only partially solved. It has been completely solved in only two infectious diseases, diphtheria and dysentery. However, in other infectious diseases, as streptococcic infections, scarlatina, croupous pneumonia, typhoid fever, relapsing fever, plague, and cerebrospinal meningitis, serotherapeutical attempts have been made which deserve recognition. To these may be added the favorable results obtained in the tuberculin treatment of tuberculosis. Otherwise the therapy of acute, infectious diseases is symptomatic and expectant, whereby the diet, treatment

of the fever, careful nursing, and care during convalescence play an important part.

Specific Treatment

Specific Treatment of Diphtheria.—Behring and Kitasato proved that the serum of immunized animals, in diphtheria, is able to neutralize the toxin, and that it is possible by transfusion of this serum to protect against the disease, and, on the other hand, to cure it even after it has already developed.

The small animals of the laboratory may, according to Behring, be immunized in different ways. Sterilized bouillon cultures of diphtheria bacilli are injected subcutaneously, or the culture to be injected is previously mixed with a solution of trichlorid of iodin. Or, after subcutaneous injection of the bacilli, a 1 to 2 per cent. solution of the trichlorid of iodin is injected, or an injection of hydrogen peroxid is given before inoculation. The serous exudate of guinea-pigs which have succumbed to injection may be used for immunization, as the pleural exudate contains the toxin, but never the bacilli. The blood of the animals treated in this manner possesses no bactericidal properties against the diphtheria bacilli. On the contrary, it seems that the bacilli growing in the immune serum possess an increased toxicity. Thus Behring in 1890 succeeded in dividing the protective substances in the serum into two groups, bactericidal and antitoxic. With this, the diphtheria antitoxic therapy was discovered.

By the investigations of Roux and Martin it was found that the horse could be very rapidly and surely immunized; at the same time it has the advantage of furnishing large quantities of serum. Immunization of horses is produced by the injection of very small quantities of diphtheria toxin, with gradual increase of the dose. In the beginning it is advisable to add substances which reduce the power of the toxin in order to prevent the death of the animal. It has been found that the best method is to add an insufficient quantity of antitoxin to the toxin on the first injection of the animals.

It is interesting that the diphtheria antitoxin passes into the milk of animals which are suckling their young. Though this observation has not led to practical application, it has proved that, on nursing, immune bodies may pass from mother to child, which points to the great advantage of the natural feeding over the artificial form.

Of great importance for the exact use of diphtheria antitoxin is the possibility of determining its antitoxin content, as introduced by Ehrlich. The old determination of Behring is no longer in use.

Danger of Diphtheric Infection in General.—The danger of diphtheria lies, first, in the local affection, which leads to swelling of the

mucosa, and, especially in small children, is followed by a threatening stenosis of the air-passages; secondly, in the general effect of the toxins, which have been isolated by Roux and Yersin. In light cases of localized faucial diphtheria the patients, who are usually children, are somewhat fatigued, drowsy, and have a slight fever. On inspection of the pharyngeal organs we see that the mucosa is reddened and one tonsil, or more seldom both, swollen. On the tonsils and at times on the posterior pharyngeal wall we find coatings, which at first are cob-web-like, and only later densely fibrinous, as may be shown by pressing a removed portion between two slides. On the under surface of the coating we find nests of diphtheria bacilli, which may be demonstrated in the cover-glass preparation by staining with Löffler's methylene blue and by culture. The progressive faucial diphtheria, which produces a fibrinous exudate on the faucial organs and the walls of the naso-pharynx is soon followed by severe general manifestations. Beside the oral and nasal cavities, the aerial passages, Eustachian tube, and middle ear may be involved; a nephritis of moderate degree is very frequently present.

Septicemic Type.—The so-called septicemic diphtheria is especially dangerous on account of its severe toxic effects. It occurs in about 10 to 11 per cent. of all cases, usually in persons above four years of age, and develops from a localized or progressive diphtheria. In this hypertoxic form of diphtheria, death sometimes occurs in twenty-four hours; fever, sopor, cardiac weakness, and cyanosis set in suddenly; the tonsils are only slightly reddened and swollen, and are covered with a fine veil.

Malignant Diphtheria.—This form without the typical localization is very rare. In this malignant form we do not have to deal with a mixed infection with streptococci or putrefactive bacteria, but with the Löffler bacillus alone, which if of sufficient virulence and on a favoring predisposition of the individual is able of itself to produce this fatal type.

Distant Effect of Poisons.—*Heart Symptoms.*—The cardiac symptoms consist in the small, often filiform, very rapid pulse, and in a peculiar dulness of the cardiac sounds, especially of the first mitral sound. The retarded circulation leads to a slight cyanosis and to a striking coolness of the extremities. Over the heart, the so-called pendular rhythm—embryocardia—may be heard, in which, as in the fetal heart, the pause after diastole is not longer than that after systole. In other cases a marked gallop rhythm is heard in which the accent lies on the middle one of the three sounds heard.

Kidneys.—The kidneys in severe diphtheria are involved almost constantly, but only rarely to a dangerous degree. In severe cases one finds, beside a large amount of albumin, coarse granular casts

and strata of epithelial cells. Hematuria, hydrops, and uremia are rarely observed, because in such severe cases death occurs soon from general intoxication.

Paralyses.—Paralyses occur after septic cases, together with cardiac weakness and general prostration, and are usually of an unfavorable prognosis. But light cases of diphtheria, six weeks after apparent recovery, may lead to paralyses, which may become a difficult problem for the physician. It is not rare that a diphtheria is entirely overlooked and that children are brought to the physician on account of their nasal speech or choking, or, in school children, for their inability to see objects near at hand. The anamnesis will show that a sore throat has existed a few weeks previously. The paralysis appears from the second to the sixth week after the disease. The soft palate is involved very early if there has been an extensive croupous inflammation of the velum palati. This is perhaps not due to the general action of the toxins, but rather to their local effect, produced in the mucosa on the underlying musculature. The picture of postdiphtheric paralysis is usually a typical one. The child talks through the nose, the velum hangs relaxed on phonation, liquids are regurgitated through the nose on hasty drinking, or sometimes get into the lungs, causing coughing spells, or even pneumonia by aspiration, pulmonary abscess, gangrene, or empyema. The internal muscles of the eyes are almost constantly involved. The children, being unable to accommodate, can only read with strongly convex lenses. The external muscles of the eye and the facial nerve may also be involved. The patellar reflexes, increased in the beginning, cannot be elicited in the further course. A severe ataxia of the upper extremities may be observed. In severe cases there develop extensive paralyses of the vocal cords, of the laryngeal musculature, and of the diaphragm. In these cases the cough which can be produced is very weak from the insufficient closure of the glottis. If hemiplegia develops, it is usually due to an embolic process or to encephalites.

Local Changes.—*Diphtheria of the Nose.*—Nasal diphtheria occupies a special position in the local process, since the croupous coating may involve extensive surfaces of the mucosa without being remarked. Like tonsillar diphtheria, it usually originates in the lymphatic pharyngeal ring, but the primary focus is not in the palatine, but in the pharyngeal tonsil. The first coating is found at the pharyngeal orifice of the Eustachian tubes and on the choanæ. The nose is the most frequent location for diphtheria in infants, probably because the acid reaction of the oral cavity hinders the growth of the bacilli. The mortality of nasal diphtheria is very high—about 50 per cent. The children have snuffles, are hindered in nursing, a watery secretion oozes from the obstructed nose and frequently a little blood. Some-

times true membranes are seen. Only a careful inspection of the nasal cavity and cover-glass preparations and cultures permit us to differentiate the disease from a common coryza; otherwise a nasal diphtheria may be unobserved for weeks, until by its general manifestations or spreading to the larynx it excites attention too late. Nasal diphtheria is therefore to be regarded as the chief source of postdiphtheric paralysis, as it often is not treated at all or too late.

Tonsillar and Faucial Diphtheria; Croup.—Tonsillar and pharyngeal diphtheria is of relatively little danger if it does not involve the choanæ or the larynx. It often presents the picture of lacunar angina, and only the bacteriological examination renders the diagnosis possible. Laryngeal diphtheria, the so-called croup, involves severe danger. In about one-third of all cases of faucial diphtheria an involvement of the larynx can be found.

Prognosis.—The prognosis of diphtheria cannot be discussed independently of the treatment. A few cases under exact clinical observation prove more effectually than massive statistics the results of the specific treatment. Though paralysis may occur even after the use of antitoxin, this will mostly be the case if the serum has not been used in sufficient quantities or too late, after the toxins have already exerted their injurious effects. If a pharyngeal diphtheria has been treated at the right time with sufficient doses of antitoxin, laryngeal stenosis is almost never observed. In diphtheria wards it is observed that those children who do not require tracheotomy or intubation in the first two or three days after their arrival—before the antitoxin has time to act—will not need the operation later on.

Specific Treatment.—It is desirable that the serum be injected as soon as possible, latest on the fourth day. The following doses are recommended:

1000 A. U. in simple tonsillar diphtheria.

1500 A. U. in progressive pharyngeal and nasal diphtheria.

2000 to 3000 A. U. if the larynx is involved, and at least 3000 in septic diphtheria. If no improvement takes place after twenty-four hours, the injection must be repeated with a higher dose. Against the postdiphtheric processes the diphtheria antitoxin is of no more effect than mercury in the metasyphilitic diseases. The serum injection is best made in the skin of the abdomen or on the thigh over the fascia lata. Abscess formation is almost never observed on injection unless there has been great carelessness in the antisepsis. The skin is cleaned with soap, alcohol, and ether, and the serum is injected with a sterile syringe containing 5 c.c. The wound is closed by cotton and iodoform collodion. If the price does not play any rôle, it is advisable to use a serum of high valency, which contains 500 A. U. in 1 c.c. serum. The manifestations of serum disease, as

fever, erythema, urticaria, swelling of the eyelids, etc., though not dangerous, are disagreeable; they do not depend on the number of antitoxin units injected, but on the number of cubic centimeters of horse serum injected, and will therefore be less pronounced if a serum of high valency is used. Especially in those cases where a former injection has been given, and therefore a certain sensitiveness exists in the organism against the serum (anaphylaxis), it is decidedly preferable to use a serum of high valency in order to avoid large amounts of it.

Other Therapeutical Means.—*Gargle.*—For practical reasons, the other therapeutical measures which deserve consideration will be given. Gargling with antiseptics is useful; it is inadvisable, however, to spray the nose, as local infection of the middle ear may be produced by it.

Inhalation; Cutaneous Irritation.—On involvement of the larynx, inhalations by means of the usual apparatus will be useful, especially the strong, uninterrupted steam jet; cutaneous irritation sometimes acts favorably, though only transiently, as sponging with hot water and ice-water alternately. Two bowls, filled with hot water at 50°C. and with ice-water, are placed near the child, and sponges dipped in the two bowls alternately are pressed for a quarter of a minute against the trachea. After a few minutes the swelling of the mucosa decreases, owing to the energetic cutaneous irritation, and the stenosis is relieved. Inhalation of oxygen is sometimes of good though transient effect, especially for tiding over the period during which the serum is developing its action.

Intubation.—If the dyspnea reaches a dangerous degree, intubation must be performed. It is usually followed by complete relief of the shortness of breath, unless the process has already progressed to the finer bronchi or the tube has become obstructed by mucus or membranes. The latter accident demands immediate removal of the tube by means of the thread which hangs out of the mouth; for this reason intubation is to be used in private practice only when an experienced nurse is present. After twenty-four hours, the tube may be removed. If dyspnea appears anew, reintubation must be performed. In very small children who are unable to cough up through the tube and in patients where intubation gives no relief, tracheotomy must be performed.

Tracheotomy.—We distinguish a primary and a secondary tracheotomy according as it has been preceded by intubation or not. The prognosis of the secondary tracheotomy is more unfavorable. Tracheotomy is to be preferred to intubation:

1. In children under one and one-half years, who have not the force to expectorate through the tube nor to swallow promptly.

2. On extension of the process to the bronchi and in an existing bronchopneumonia.

3. On extensive discolored coatings or on necrosis of the pharynx.

4. In those cases where intubation has produced decubitus and the dyspnea continues.

Some authors advise leaving the tube in place after painting it with astringents, believing in this way to avoid the formation of cicatrices and stenosis.

Tracheotomy is to be made as low as possible in laryngeal croup, in the part of the larynx between the thyroid and thymus glands. Careful nursing of the child after the tracheotomy, the supply of moist air by means of the steam spray, and frequent cleansing of the internal cannula are of great importance for a favorable course. The cutaneous emphysema, developing after tracheotomy, is absolutely of no significance, since the air which has penetrated into the interstitial tissue is resorbed in a few days without doing any damage. Hemorrhage from the trachea due to erosion of a vessel is a disagreeable accident. It may become necessary to introduce a tampon-cannula to arrest the bleeding. The tracheotomy tube is first changed after four days. In favorable cases one may try to dispense with it. However, it is possible that the opening may become closed after a few hours, and the child suffers from the severest dyspnea, so that life can only be saved by the energetic intervention of the physician, who has again to introduce the cannula. After the first change, the tubes should not remain longer than twenty-four hours. The tubes should vary in their length and width and curvature, so that the same part of the trachea is not always compressed, and decubitus may thus be avoided. The removal of the tracheal cannula is sometimes very difficult, especially if the cannula has been used for a long time, as the child may have forgotten how to breathe through the larynx; a state of excitation and spastic closure of the glottis may then develop. In these cases one may sometimes succeed only by giving the child a sedative before removal of the cannula or tube. By the administration of 1 gm. sodium bromid with 5 mg. codein hydrochlorate, it may be possible to remove the cannula which before seemed impossible.

Treatment of Postdiphtheric Conditions.—In treating the postdiphtheric conditions, absolute rest in bed, roborant but light diet, and tonics, as iron, quinin, and strychnin, are the chief indications. Paralysis of the diaphragm and of the muscles of deglutition demand special attention, and on choking, feeding by sounds must be instituted in order to avoid an aspiration pneumonia. If nephritis is present, an appropriate diet will have to be given which will relieve the kidneys. In weakness of the heart, cardiotonics, as camphor,

strychnin, caffein, and strophanthus, must not be spared, but unfortunately in many cases their effect will be unsatisfactory.

Specific Treatment of Rabies.—Though the infective agent is still unknown in hydrophobia, we possess a successful prophylactic treatment for it. Rabies appears in human beings in the majority of cases in its quiet form, characterized by states of depression. More rare is the classical picture of rabid hydrophobia with tonic spasms of the muscles of deglutition, followed by general cramps. Before the end, which results in a few days from heart failure, paralysis may dominate the picture.

Attempts to immunize against rabies had been made before the time of Pasteur by Galtier, who tried to immunize sheep by the intravenous injection of saliva from animals suffering from rabies.

In 1883, Pasteur succeeded in protecting dogs against the bites of mad animals by treating them first with the attenuated, and then with a stronger virus (emulsion of the spinal cord). He obtained this attenuated virus by repeated passages through apes; with this attenuated virus he inoculated rabbits; and emulsions of the spinal cords of these rabbits were injected into mad dogs. Later the attenuation was accomplished by passing the virus found in the brains of mad dogs (street virus) through rabbits. Rabbits inoculated under the dura with street virus, come down with the disease after about fourteen days. The medulla oblongata of the dead animals is again infectious for rabbits. It has been observed that, on continual vaccination of the rabbits, the time of incubation constantly diminishes, until it reaches its minimum of about seven days. This poison, altered by the continual passage, is called "virus fixe."

The treatment of human beings who have been bitten by rabid animals is performed by means of the virus fixe. The rabbits are killed one day previous to their expected death, the spinal cord is removed under aseptic precautions, a piece 1 cm. long is rubbed up with 5 c.c. physiological salt solution, and 1 to 3 c.c. of this emulsion are injected into the patient under the skin of the abdomen.

The virus fixe may be further attenuated by drying it over caustic potash, whereby it loses its virulence for rabbits after about eight to ten days. In human rabies it takes from twenty to sixty days for the first symptoms of the disease to develop. Children have a short incubation; the same is true after extensive injuries by the rabid animal and of all bites in the region of the central nervous systems (lesions of the head). The incubation period is prolonged by disinfection or cauterization of the wound, as this procedure destroys a part of the virus; it is further prolonged if the infecting froth of the animal's teeth has been received on a part of the body protected by the clothing. The danger of the case may be estimated from these

factors and a corresponding light or energetic treatment may be instituted.

The entire immunization lasts about fourteen days, and is not necessarily carried out in a hospital. According to experimental investigation, two weeks are necessary to attain an effectual protection. Cases that show symptoms of the disease before this time cannot be regarded as failures. Pasteur's vaccination against rabies is a postinfectious immunization, which is rendered possible by the long period of incubation. If hydrophobia has once developed, it cannot be cured, but leads to death in three to six days, if, disregarding the prodromal stage with fever and pain in the wound, we count the onset of the disease from the appearance of the spasm of deglutition.

The fear of injecting at once the fresh virus fixe is entirely without foundation, for the spinal cord of the rabbit is not infectious for a human being, but is only immunizing. To-day we do not use the original method of Pasteur, but begin with the less virulent emulsions of cord substance, and increase, slowly or rapidly as the case demands, to the virulent virus.

Specific Treatment of Tetanus.—Tetanus bacilli cause infections only rarely, nevertheless they are ubiquitous, because of their low energy of growth. The enormous toxicity of the metabolic products is able to produce the disease, though few organisms have gained an entrance into the body. Of domestic animals, only the horse is affected naturally with tetanus. After an incubation period of one to two weeks the disease develops with tonic spasms of the muscles of the jaw, neck, and face, and finally of the whole musculature of the body.

Historical.—In 1890, v. Behring and Kitasato reported that rabbits could be protected against not only twenty times the lethal dose, but against the infection by the living organism, by the injection of increasing doses of tetanus toxin. The serum of these rabbits possesses antitoxic properties and neutralizes the toxin also *in vitro*.

The toxin used in the preparation of animals whose serum is to be used may be attenuated in different ways. Trichlorid of iodin or antitoxin may be added; or it may be heated or passed through non-susceptible animals, as pigeons.

Indication.—The tetanus antitoxin is used prophylactically in all injuries in which pollution with garden earth has occurred or on penetration of a foreign body into the tissues. Twenty antitoxin units will be sufficient to prevent any trouble.

Mode of Action and Prognosis.—If the disease has once developed, recovery can be brought about by the use of antitoxins only as long as the lethal dose of toxin has not been resorbed by the nervous system. Neutralization of the toxin within the blood is easy. It is much more difficult to accomplish it in the tissues, where a high con-

centration of antitoxin in the blood is necessary. Parenchymatous injections of antitoxin in the neighborhood of the wound are advisable.

If the nerve along which the toxin probably travels toward the central nervous system is easily accessible, the antitoxin may be injected into it directly, in this way a source of infection for the brain being cut off, which otherwise could not have been reached. It has been proposed to inject the toxin directly into the brain or spinal cord, but, though theoretically justified, this can scarcely be risked. The antitoxin has been injected subdurally, after lumbar puncture, with good success: of ten cases treated in this way, eight recovered.

Tetanus serum is indicated in every case which is diagnosed.

The failures in its use in cases which develop rapidly after a short incubation period are due to a too rapid production of poison and its fixation by the central nervous systems. These cases do not discredit the use of the serum, but should be a stimulus to its early use.

Serum Preparations Commonly Used.—v. Behring's serum has a strength of 100 antitoxin units for curative effect and 20 for immunization. Dried antitoxin of 20 immunity units can be obtained, and is chiefly used for the treatment of wounds.

Tizzoni and Cattani's tetanus serum is placed on the market by Merck in bottles containing 5 gm. of the dried serum, corresponding to 5,000,000 A. U.

Cellular Antitoxin of the Brain.—Wassermann and Takaki made the interesting discovery that a fine emulsion of the brain of a normal guinea-pig, injected subcutaneously, protects against the tetanus infection. The tenth part of the brain immunizes against ten times the lethal dose, but even on sixty times the lethal dose, a marked amelioration is recognizable in the course. This discovery, though of great theoretical interest, has as yet found no practical application.

Specific Treatment of Tuberculosis.—Most infectious diseases heal with the production of active protective substances in the serum, which leave active immunity for a varying period of time. Yet there are infections, as erysipelas, influenza, and, above all, tuberculosis, where this reaction is deficient. This failure of antitoxin in tuberculosis is due to the small quantities of toxins which enter the circulation, on account of the slow growth of the strongly localized bacilli, which are encircled by a necrotic focus, poor in blood-vessels.

Koch's Tuberculin.—Of all the attempts at immunization against tuberculosis, Koch's treatment with tuberculin is still the most successful.

Mode of Action and Importance for Diagnosis.—Tuberculin acts chiefly by producing an increased inflammation around the tubercular

focus, and the resulting necrosis is due to the union of the toxins formed in the organism with those injected into it. There is no direct specific effect on the bacilli, but the necrosis renders the conditions unfavorable for their growth. In doses of 0.01 or of 0.001 gm. and even in much smaller doses, it produces in tubercular persons an acute febrile exacerbation, with chills and muscular pains and local manifestations at the point of injection in the form of local inflammatory edema, sometimes with painful swelling of the regional glands. The dulness in the affected lung increases, and dry and moist râles may be heard; small hemoptyses may occur.

The danger of mobilizing and spreading the tubercle bacilli in the organism may be excluded, according to the most extensive statistics. The carefully performed tuberculin injection for diagnostic purposes is a safe and valuable method of demonstrating the existence of latent tubercular foci. The reaction does not, however, permit any conclusions as to the severity of the case. Indeed, one may observe that active but closed tubercular areas of small extent give a very violent reaction, while a severe ulcerative phthisis scarcely reacts at all. Encapsulated foci react little or not at all. As otherwise healthy individuals may have a latent tubercular focus perhaps in a bronchial gland, which bears no relation to the dominating disease, a positive reaction must be interpreted with care. The tuberculin test is to be performed only on afebrile patients; 0.001 gm. is injected; after an interval of two days, if no reaction has occurred, 0.005 gm., and eventually 0.01 gm. The last dose may be repeated. If after any of these doses a febrile reaction occurs, for whose presence one-half a degree centigrade of rise is sufficient, the same dose may be repeated, as a certain cumulative effect causes a more violent reaction the second time.

In children under five years, doses of 0.3 mg., 0.6 mg., and 1.5 mg. are indicated; between five and ten years, 0.5 mg., then 1 mg., and 5 mg.

Specificity of the Tuberculin Reaction.—The tuberculin injection produces reactions in lepra, actinomycosis, and syphilis, though less markedly. Many of these observations may be due to a simultaneously existing tuberculosis, though in biological processes, it is by no means unusual that organisms nearly related react similarly, but quantitatively different. By this group reaction it is proved that tubercle bacilli belong to the same class of microorganisms as lepra and actinomycosis. As far as syphilis is concerned, its morphological separation from this group has been proved by the discovery of the spirocheta pallida.

v. Pirquet's Cutaneous Reaction.—v. Pirquet has recently employed the cutaneous application of tuberculin instead of the

injection. The appearance of a red areola or papule within one to three days furnishes an entirely harmless and easy method of diagnosis. This reaction is of decisive value only in early childhood.

Opthalmo-reaction.—By the instillation of a drop of a 1 per cent. tuberculin solution into the conjunctival sac Calmette and Wolff-Eisner obtained a marked reaction in tubercular patients, which became manifest in a few hours, from the reddening of the palpebral conjunctiva. Though the positive test speaks decidedly for tuberculosis, the negative one does not necessarily speak against it.

Therapeutical Attempts with Old Tuberculin.—The successful treatment with tuberculin depends on the right indication and on a careful individual procedure. The unfavorable results which discredited its use are due entirely to its incorrect application. One must take care to avoid any rise of temperature by beginning with minimal doses and returning, on the slightest reaction, to the next smaller dose. The final dose, according to Penzoldt, should be 0.02 gm.; Petruschky advises treatments with intermissions (Etappen-Verfahren).

Other Tuberculin Preparations.—Klebs has advocated his tuberculocidin, and later his antiphthisin, in the treatment of tuberculosis, but as yet the results have not been very encouraging.

Maragliano's Serum.—Of the attempts to immunize passively against tuberculosis with the serum of naturally immune, or actively immunized animals, Maragliano's experiments deserve some attention. His immune serum is doubtless effectual in the animal experiment, for it neutralizes lethal doses of tuberculin in the guinea-pig and mitigates, in the human being, the reaction of simultaneously injected tuberculin doses, which alone would produce fever. He immunized horses actively with toxalbumin and tuberculin and uses the serum of these highly immunized animals in the treatment of tubercular individuals in doses of 1 c.c. given every second day for six weeks.

Latest Method of Treatment on Bacteriological Basis.—v. Behring, believing that the primary infection with tuberculosis occurs in early childhood through the milk, advises protecting infants by feeding them with the milk of highly immunized cows.

It is easily understood that time has not yet shown the practical value of this method.

Marmorek's serum has been used with encouraging results, especially in surgical tuberculosis (Hoffa). It is given in doses of 5 to 20 c.c. by the rectum.

Treatment with Hetol (*Cinnamonate of Sodium*).—The treatment of tuberculosis has been attempted with chemotactic substances, which are supposed to produce inflammation and leukocytosis around the tubercular focus. Landerer used balsam of Peru, later on its active

principle, the cinnamonic acid. This may be used in the form of emulsion or as a 1 to 5 per cent. solution of sodium cinnamonate, which appears on the market under the name of hetol. It is injected into the cephalic vein under completely aseptic conditions. Landerer begins with 1 to 2 mg. hetol, injecting 1 mg. more every second to third day, until 25 mg. are reached. After the injections he observed decrease of cough, expectoration and bacilli, and an increase of the body weight. Purely tubercular fever is said to cease in one to eight weeks, whereas the septic fever of mixed infection seems to increase. By too large doses a rise of temperature and a persistent leukocytosis are produced; the latter is intentional, but should disappear after twenty-four to forty-eight hours. The intravenous injection is sometimes somewhat difficult in children, and injections into the gluteal muscles are preferable. In any case, its harmlessness is assured.

Staphylococcus Sera.—v. Lingelsheim's remarks on the attempts to prepare a staphylococcus serum apply more or less to all other attempts to accomplish results in the other infections by the treatment with immune sera: "There are numerous attempts to immunize animals and obtain protecting immune bodies from them. There are numerous methods by which these attempts were made. It may be said that every theoretically conceivable possibility has been tried in practice by some experimenter." The first attempts to produce passive immunity in staphylococcus infection have been made by Richet and Hericourt, who protected a rabbit by the defibrinized blood of a dog immunized against this infection. However, this success in the animal experiments has not led to a practical application in the therapy, though a need of it certainly exists. For staphylococcus infections are very common, and also true staphylococcus septicemia, usually of severe nature, may be observed.

The common mixed infections of staphylococcus and streptococcus septicemia would demand the mixture of a streptococcus serum as the only complete specific treatment.

There exist several staphylococcus sera which are supposed to be active, as that of Peterson. It has been used too little, however, for any opinion to be pronounced as to its effectfulness.

Wright treats local staphylococcus infections by immunizing the organism actively by injections of killed staphylococci.

Streptococcus Sera.—If we believe that there exists an habitual streptococcus infection, which relapses constantly (erysipelas), and that after repeated streptococcic infections the disease may occur anew, we see that this affection leaves no immunity, and therefore that any attempt to obtain a passive immunity appears hopeless.

History.—After the discovery of the diphtheria antitoxin, Behring tried to immunize against the streptococcus longus, first

infecting his animals with attenuated cultures, later with entirely virulent ones.

Marmorek.—A few years later Marmorek prepared an anti-streptococcic serum in the following way: He injected cultures of streptococci from scarlet fever patients into horses; he maintained the cocci at high virulence by passing them continually through rabbits, but in this way gained a serum which was useful for only one strain of the cocci. By the passage through animals these cocci, though highly virulent for animals, had lost their virulence for man. Not alone from these theoretical considerations, but from the little favorable reports on the part of leading clinicians, it may be understood why Marmorek's serum is so rarely used.

Polyvalent Sera.—Newer research has proved that there is not merely one race of streptococci, but numerous ones, and that it is therefore impossible to immunize with one strain of streptococci against all others. Thus Denys and his pupil, van der Velde, prepared a polyvalent serum, using a great number of fresh virulent strains.

Tavel.—From the same theoretical point of view, Tavel prepared a serum using a great number of strains which had been obtained directly from human beings, hoping in this way to obtain the greatest possible polyvalence and an adaption to existing conditions.

Menzer.—The specificity of streptococci induced Menzer to recommend a serum against articular rheumatism, which he obtained by means of streptococci from the tonsillitis preceding acute articular rheumatism.

Aronson; Paltauf.—Aronson and Paltauf, as well, prepared still another streptococcal serum.

v. Leyden.—v. Leyden recommended the serum of patients convalescent from scarlet fever for its treatment in others—a procedure which, in general, will be impossible to carry out.

Moser.—Moser gained his streptococci from the heart's blood of children who had died from scarlet fever, and cultivated them in bouillon without passage through animals. As it was not the bouillon filtrates, but the cultures themselves, which were injected into the horses, he obtained a polyvalent bactericidal and antitoxic serum, whereas Marmorek's serum is monovalent and more antitoxic, as only filtrates are used in its preparation.

Mode of Action of Moser's Serum.—However, Moser's serum acts best in the severely toxic cases if it is injected within the first three days of the disease; the severely infectious forms are only slightly influenced, and the serum loses its effect after the fifth day.

From the experience with Moser's serum, which was gained on 200 children in Escherich's clinic in Vienna, it results that lymph-

adenitis, pharyngeal affections, and nephritis are not influenced at all in their course. On the other hand, septic diarrhea ceases; the manifestations of collapse and the peripheral coolness and cyanosis improve; the pulse becomes stronger, and the sensorium clear. The serum is effectual only in large doses so that very violent symptoms of serum disease may arise, though they are never dangerous.

Indications of Moser's Serum.—The serum should, therefore, be injected only in those cases which without it would probably pursue an unfavorable course. In Escherich's clinic 200 c.c. of the serum are injected under the skin of the abdomen, the point of injection being closed with cotton and collodion. The opinions of other authors regarding the value of Moser's serum are in part favorable, in part skeptical. Certainly great differences exist between the sera of different horses, as only a small number of the horses injected produce an active serum.

Prognosis in Scarlet Fever.—The prognosis of scarlet fever is only to be made after a careful consideration of all the factors influencing the disease. If we regard the sequelæ which are entirely uncalculable, and which may transform the lightest case into a fatal one, in the first few days it will be quite impossible to form any opinion as to the severity of the course. On the third day a probable prognosis can be made by an experienced man, which, according to Moser, may be divided into four groups:

Group I.—Light cases with favorable prognosis.

Group II.—Moderately severe cases with good prognosis.

Group III.—Doubtful cases.

Group IV.—Probably fatal cases.

If on the third day prognosis III cannot be excluded it will be wise to inject serum.

The following points will be found helpful in making the prognosis: A severe course is announced by the so-called double exanthem, which, besides the small patches, shows "large, reddish-brown, slightly elevated, efflorescences" (v. Pirquet). Cyanosis; coolness of the extremities; and a profuse mucopurulent discharge from the nose, which has a disagreeable odor and leads to excoriations at the nasal orifices; discolored, greasy, confluent patches on the tonsils, which spread over the surrounding tissue; decay of the palatine arch and of the soft palate; uncontrollable vomiting, and green, foul-smelling, numerous, liquid stools are symptoms which mark a severe case. Of ominous significance, further, is a hyperpyrexia (above 40.5°); below this temperature no connection between height of fever and prognosis can be observed. The pulse becomes small, filiform, and very frequent, and the respiration is much increased. The sensorium is more or less involved. High temperature, tachycardia, pronounced

faucial symptoms, and a purulent coryza will speak for prognosis III only in children under three years; in elder children these symptoms may often be observed in moderately severe cases, with favorable course (v. Pirquet).

General Indications for Treatment with Streptococcic Serum.—According to the opinion of Fr. Meyer, every severe angina, scarlatina, erysipelas, puerperal process, or other wound infection should be treated with streptococcic serum if greasy patches, an early severe involvement of the glands, tachycardia, stupor, or restlessness indicate a severe course, or if streptococci have been cultivated from the blood—a condition by no means always associated with chills and high fever. Cardiac weakness will demand the serum injection, and in septic diphtheria both sera should be combined. The serum injection promises but little success in severe septic erysipelas; it is indicated if a discolored discharge, chills, high pulse-frequency, and dry tongue are present before the deplorable picture of a severe septicemia or septic peritonitis has developed.

Technique of Injection.—The antistreptococcic serum is injected under the skin of the thigh, abdomen, or chest, after careful disinfection of the skin, in quantities of 10 to 20 or even 100 to 200 c.c.

Contraindications for Serum Treatment.—Serum injections, even in the smallest doses, are contraindicated in cardiac failure, pleurisy, pericarditis, and in large encapsulated pus foci in vital organs. For the intracellular toxins of the cocci are first liberated by the injection of serum and, not being easily removed from closed cavities, produce very injurious effects (Meyer).

The favorable effect of the serum is announced by the drop in temperature and pulse and, by general euphoria.

Sera Most Commonly Used.—The sera most commonly used are:

1. Serum Marmorek (Paris).
2. Serum Moser.
3. Serum Paltauf (Vienna).
4. Serum Aronson (Berlin).
5. Serum Menzer (Darmstadt).
6. Serum Tavel (Landsberg).
7. Serum of Lyons.
8. Polyvalent serum of Denys, van der Velde (Louvain).
9. Serum of the British Institute of Preventive Medicine.
10. Serum Burroughs Wellcome.

Pneumococcic Sera.—*Foà and Carbone.*—Foà and Carbone applied the methods of serum treatment in diphtheria and tetanus to the pneumococcic infections, and were the first to try, on a pneumonia

patient, a serum gained by immunization with sterile diplococcic cultures.

G. and F. Klemperer.—G. and F. Klemperer tried to immunize animals with their "pneumotoxin," and employed the serum in six cases of pneumonia, with apparently favorable results.

Washbourn.—Washbourn immunized a horse with killed diplococci, finally injecting a living bouillon culture, and the serum protected not only animals, but also human beings, against a pneumococcal infection.

Pane.—Pane immunized cows and asses with highly virulent pneumococci and found them, especially the serum of the asses, very active. He treated thirty-two cases of pneumonia, of which three died. Also other Italians and Englishmen have obtained good results with this serum.

Others have tried the serum of patients convalescent from pneumonia, as well as normal serum, which contained antibodies for the pneumococci.

Cause of the Small Success of the Pneumococcic Serum Therapy.—All these attempts have been performed, as Weichselbaum states, without a thorough knowledge of the manner in which diplococcus immunity is brought about. Conditions here are different from those in diphtheria and tetanus, where soluble toxins are formed by the bacteria and antitoxins are contained in the serum. The pneumococci contain their toxins within the bacterial bodies, and immunization depends on bactericidal substances.

The toxic effect of the bacterial cell is due to different groups, each of which can fix a certain immune body. From this Römer concluded that a bactericidal serum should contain immune bodies for as many of these groups as possible, and best for all.

Römer.—Römer's pneumococcic serum, which he used originally in ulcer of the cornea, and later also in pneumonia, is a bactericidal serum which is polyvalent in a double sense, for different species of animals, horses, cattle, and sheep, are immunized with different strains of pneumococci which are pathogenic for man. This mixture of heterogenous sera produces much less intense symptoms of serum disease. Pässler, in Curschmann's clinic, treated twenty-four cases with this serum, of whom four died. With the exception of serum exanthems, in 25 per cent. of the cases he saw no disagreeable secondary effects. The injection is usually followed by a feeling of well-being; in one-half of the cases there was the impression that the crisis, or at least a considerable fall of temperature, was produced by the injection. Forty per cent. of cases were in the state of defervescence on the fifth day of the disease. The hepatization of the lungs was not arrested in its development. The circulatory disorders were

markedly improved, the pulse wave becoming larger and its tension higher, provided no pneumococcic endocarditis was present. A criticism of these results may be that Spolverini observed similar improvement after injection of normal serum. It is an important fact that with the whole treatment with Römer's serum 50 per cent. of all pneumococcemia recovered, whereas, according to Lenhartz's statistics, only 15 per cent. of the cases with pneumococci in the blood usually recovered. Pässler expresses his opinion in the following words: "Though the curative effect of Römer's pneumococcic serum in fibrinous pneumonia must be considered uncertain and incomplete in most cases, it is, taking into consideration the therapeutical results, superior to all other measures which may be directed against the infection itself." He recommends the serum in cases of especially virulent infections, in pneumococcemia if leukocytosis is absent, in the presence of leukopenia, in cardiac weakness, threatening pulmonary edema, and in alcoholic and marantic individuals. He recommends doses of 20 c.c.; if after a transient improvement there is an exacerbation, a second injection is indicated which, however, is useless if the first injection has proved ineffectual.

Passive Immunization of Typhoid Fever.—Chantemesse and Widal made several attempts to produce an active immune serum against typhoid fever. Bactericidal sera, according to Pfeiffer and Kolle, are dangerous, owing to the endotoxins which are liberated on the death of bacilli. The production of an antitoxic serum has failed as yet on account of the impossibility of obtaining typhoid toxins.

Recently Kraus and Stenitzer, and Meyer and Bergell and Aronson, state that they have succeeded in producing active typhoid toxins. By immunizing goats and horses, they obtained antitoxic sera which, in experiments on rabbits, neutralized not only the typhoid toxin, but, according to Kraus, also the paratyphoid toxin. However, it has been used too little in human beings to judge of its value.

Dysentery Sera.—Any specific therapy in dysentery presupposes an exact bacteriological diagnosis, by cultural methods or agglutination. This is very important in this affection, which may be produced by two different types of bacilli, the Shiga-Kruse bacillus and Flexner's bacillus.

Bacillar dysentery, like the amebic form, is an affection of the mucous membrane of the large intestine, which at the onset, and in light cases, resembles a catarrh of the large intestine, characterized by tenesmus and frequent scanty, muculent stools. In severe cases with ulceration and necrosis, the stools consist of mucus, blood, pus, and shreds of mucosa. Disturbances of the vascular and nervous systems must be ascribed to the toxins.

Shiga and Kruse immunized horses with dysentery bacilli, and

produced in this way sera that had a curative effect in man. Kraus and Doerr proved that this serum was not bactericidal in its action, and showed that the Shiga-Kruse bacillus produces a soluble toxin which, in rabbits, arouses dysenteric processes in the intestines. Therefore, this type of dysentery is a toxicosis, and the immune serum is antitoxic in its action.

Kraus and Doerr, Vaillard and Dopter, Rosenthal, Barikin, and many others have tested their antitoxin sera on man, and agree on their excellent curative results. Twenty to 30 c.c. are injected, which may be repeated in the next two to three days. A marked euphoria, and the disappearance of diarrhea and of blood, announce a rapid recovery. The serum is also useful prophylactically, as are the other anti-toxic sera, but the immunity obtained lasts only two to three weeks.

Flexner's bacillus does not produce a soluble toxin, and the serum prepared by Gay is therefore of purely bactericidal action. In children, follicular enterites frequently occur, which, according to Leiner and Jehle, have to be considered as infections due to the dysentery bacillus (Regner). This condition may be suspected if the stools are very poor in bacteria, especially if only a few Gram-negative, short, plump bacilli are found among numerous pus corpuscles. Flexner's serum has not yet been tried in these cases in a way to permit any conclusions. Kraus and Doerr immunized their horses with toxins, and in this way gained a serum which could be easily standardized. Their serum, in doses of 0.1 c.c., protects rabbits which have received, immediately before, a lethal dose of toxin.

Specific Treatment of Plague.—Against plague there exists an undoubtedly effective active immunization, which affords a relative protection for several months and mitigates the violence of an attack occurring within this time. Yersin, and later Roux in the Pasteur Institute, prepared a "serum-antipesteuse," by injecting horses, at first with dead, later with completely virulent, bacilli, and finally with their toxins.

The injection of the serum produces immediate immunity in man, whereas active immunization affords protection only after a certain time, when the reaction has disappeared. If the disease has once developed, curative effects cannot be expected from the plague sera, though a certain influence on the clinical course cannot be denied.

In cholera and influenza, the specific methods of treatment have failed of any results.

Epidemic Cerebrospinal Meningitis.—The epidemic cerebrospinal meningitis often resembles the tubercular meningitis so markedly that differentiation is only possible by lumbar puncture. The cerebrospinal fluid is more or less turbid, from its leukocyte content, and

contains many meningococci in the sediment, which have to be verified as such by culture.

Jochmann produced an immune serum by injecting horses, sheep, and goats with gradually increasing doses of various strains of the diplococcus meningitis intracellularis (Weichselbaum). It has slight antitoxic properties, but acts strongly bactericidally and agglutinates true meningococci in a dilution of 1 : 1500; 20 to 30 c.c. of the serum are injected subcutaneously and the injection is repeated on the third or fourth day. Intraspinal injections of 20 c.c. serum have been performed after 30 to 50 c.c. fluid has been removed. The results are especially favorable in cases treated early. Excellent results have been obtained with the antitoxic serum of Flexner, prepared at the Rockefeller Institute for Medical Research. Flexner's statistics show that the mortality is lowered from 70 to 80 per cent. to 20 to 30 per cent. by the use of his serum.

Vaccination.—The great prophylactic achievement which was the path-finding discovery for all succeeding specific investigations was Edward Jenner's vaccination against smallpox in 1798. He recognized that persons who had been infected with cowpox were immune against smallpox, and used this observation in his prophylactic immunization. This cowpox, transmitted to human beings, variola vaccinia, pursues a very mild course, is restricted to the point of inoculation, and causes slight general manifestations only between the sixth and ninth days. At this time the inflammation reaches its acme, and the lymph glands of the axilla are sensitive to pressure.

The immunity of smallpox lasts five years, then gradually a certain susceptibility for the disease returns, which becomes more and more marked. On revaccination, which, in Germany, is compulsory at twelve years of age, the reaction is very slight and pursues an abortive course (v. Pirquet). Vaccination is best performed with a needle, which is easily sterilized. After the skin of the deltoid muscle has been washed with soap, alcohol, and ether it is scratched at three different points, 2 cm. apart; the vaccine is then applied. The wound is covered with sterile gauze or with a special protecting material, called tegmin. If the pustules are scratched, and the vaccine thus spread over the body (autoinoculation), "secondary vaccine" occurs. This may be very extensive in children who suffer from impetigo, eczema, furunculosis, or psoriasis. If the eye is touched with the infected finger, panophthalmia, resulting in phthisis bulbi, may result, as the cornea is very sensitive to the vaccine.

If the pustule itches, it may be powdered with some antiseptic, which at the same time favors its exsiccation. If the roof of the vesicle is ruptured, aluminium acetate or Lassar's paste may be applied for twelve to twenty-four hours.

General exanthems of hematogenous origin may be produced, belonging to the group of erythemas, or to that of urticaria, measles, or rubeola. Such vaccine exanthems may be differentiated from measles by the absence of symptoms on the part of the mucous membranes.

Very rarely a generalized vaccinia is produced. This is an eruption which completely resembles human smallpox, but takes a much milder course. The dissemination occurs through the blood.

All these complications recede after immunity has been accomplished, *i.e.*, after the second week from the time of vaccination. Vaccination may be considered as successful if two out of the three pustules have developed. On revaccination, one must be satisfied with an abortive course, which ends with the formation of a small nodule.

CHAPTER XVIII

AUTOINTOXICATION

General Remarks.—The great significance which in the last few decades has been attributed to autointoxication in the various morbid conditions explains the following presentation of its doctrine, the more as immediate danger to life is not infrequently its result. Autointoxication was first recognized in its true nature by Senator, at a time when we had not learned to distinguish between infection and intoxication, and thus it was called by him autoinfection.

It is at present not possible to classify the different forms of autointoxications according to the chemical nature of the various noxæ which produce the various symptoms, because we are not sufficiently acquainted with the poisonous elements which cause the most common endogenous intoxications, as, for instance, uremia.

Division of Autointoxications.—*Senator* classifies autointoxications according to their pathogenesis:

1. Those that develop from hindrance to the normal excretions (autointoxication from retention).

2. Those developing from decomposition in normal or pathological cavities and by resorption of the putrid and fermentative products.

3. An anomaly of metabolism resulting in a pathological change in the composition of parenchyma cells or of the body liquids (histogenic and dyscratic autointoxication).

4. Those due to the metabolic products of microbes (infectious autointoxications).

To the first group belong the carbonic acid intoxications and uremia; to the second, autointoxications proceeding from the intestines, bladder (ammonemia), or pus cavities. In the third group must be included those diseases which result from disturbances in the internal secretions of the thyroid gland, adrenals, pancreas, parathyroids, ovaries, etc.

The picture resulting from a disturbed liver function may be a very complicated one, as this organ not only secretes bile and produces glycogen and urea, but also has the function of neutralizing the poisonous blood of the portal vein, which function it fulfils in the following manner, according to *Quincke:*

1. It excretes the poison with the bile.

2. It accumulates the poison, thus changing an acute infection into a protracted one.

3. It transforms the poison into a less injurious substance by a process of synthesis.

An insufficiency of the liver may be suspected from the following conditions:

1. In catarrhal jaundice, if the flow of the bile into the intestine is unaltered.
2. In cholelithiasis.
3. In certain forms of the uric acid diathesis.
4. In various glucosurias of lesser degree.

The treatment is a more or less uniform one, consisting in the administration of alkalies (Karlsbad, Vichy), and in the care for mixed diet (restriction of meat and substitution of carbohydrates and cellulose).

Removal of Poisons.—*By the Liver.*—The investigations of Bouchard and Roger concerning the neutralization of poisons by the liver have shown that vegetable alkaloids and ptomains introduced into the general circulation via the veins of the trunk have a much more poisonous action than those passing through the portal vein, as they lose more than half of their toxicity by passing through the liver. This removal of the poisons is accomplished not merely by their excretion through the bile, which only contains traces of alkaloids, but also by a transformation depending on the presence of the glycogen in the liver.

Through the Kidneys.—The kidneys, too, have the function of freeing the organism from poisons, and in performing this service they are themselves often injured. The toxicity of the urine therefore increases under certain conditions.

Bouchard injected a certain part of a twenty-four hours' specimen of urine intravenously, into a rabbit of known body weight and expressed the toxicity of the urine as the urotoxic coefficient, which amounts usually to 0.465. By this figure Bouchard expresses the weight in kilograms of the rabbit which is killed by that fraction of the twenty-four hours' urine, which corresponds to 1 kg. body weight of the individual. This determination is not of much value, as a great part of the toxins are removed through the skin, the lungs, the gastrointestinal tract, the milk, and other glands. Indeed, in some conditions, as in light cases of diabetes and the acidosis of childhood, even a larger part of acetone leaves the organism by the lungs than by the kidneys.

Division of Dyscratic Autointoxication.—The dyscratic autointoxications may be divided into three subdivisions:

1. Acidosis (by decomposition of proteins).
2. Intoxication by purin bodies (in the uric acid diathesis, nephrolithiasis, leukemia, and some cases of pseudoleukemia, by changes in the nuclein metabolism).
3. Anomalies of internal secretion.

Mixed Forms.—Different pathogenic factors may combine in producing autointoxication. Thus, in cholemia, retention of bile acids, disturbances of the internal secretion of the liver, and resorption of poisonous substances produced by intestinal putrefaction may be associated.

Intestinal Autointoxication.—Enterogenous autointoxication occurs very frequently, but is not usually of very much significance. The toxic substances produced from the proteid putrefaction in the intestines do not usually lead to toxic symptoms, because a number of protective forces exclude, under normal conditions, an injury. Resorption may be prevented by two factors:

1. By inspissation of the feces in the large intestine.

2. By the rapid elimination of the liquid stools of diarrhea, whereby the resorptive power of the mucosa is greatly reduced by the masses of mucus lying on the epithelium. Further, the toxic products are rendered less toxic by processes of synthesis or oxidation in the liver and later in the blood and tissues. Only on an insufficiency of the protective measures, which can only be a relative insufficiency, in case of a too abundant production of poisons, symptoms of intoxication arise which are recognized in the urine by an increase of the products of intestinal protein putrefaction; thus in certain forms of constipation, indol, skatol, and the phenol and cresol compounds. Here belong the hydrothionuria, and the excretion of cystin, of oxalic and hippuric acids. There exists, finally, an enterogenous acidosis of β-oxybutyric acid, with the appearance of this acid in the urine together with acetone and diacetic acid.

Clinical Forms of Intestinal Autointoxication.—*Skin.*—It has long been known that certain foods, as crabs, some kinds of cheese, and strawberries, produce urticaria and various erythemata, in individuals with a constitutional idiosyncrasy for them. Formerly the whole condition was explained as a reflex irritation of the vasomotor nerves, but at present we relate the vasomotor disturbances with certain poisons introduced from without or produced in the intestines by digestive ferments and bacterial action (antipyrin, phenacetin, codein, quinin, iodoform, sausage, fish, and cheese). There exist certain relations with the blood diseases which are yet not completely understood.

Blood.—Anemias of the pernicious type, together with gastric atrophy, have been seen to disappear by systematic lavage of the stomach; also chlorosis, by the same treatment, combined with antifermentative measures.

The relation of intestinal parasites to severe anemia is known; the bothriocephalus anemia especially will have to be explained by endogenous intoxication, and not by the loss of nutritive substances.

This conception is supported by the experience that the bothriocephalus latus is tolerated differently by different individuals; for instance, rather well by children.

Nervous System.—There are very various nervous symptoms produced by autointoxication:

1. As in many other exogenous intoxications, vertigo is frequently found in intestinal disorders, known even to the old physicians as *vertigo e stomacho læso* or *per consensum ventriculi.*

2. Headache or a sense of pressure on the head.

3. Cerebral vomiting.

4. Spasms (even tetany in gastrectasia, eclamptic attacks in children).

5. Psychical disorders, even delirium, especially in older children, who often show a special tendency to react to any constipation of several days' duration.

6. Neurasthenia, tremors, and certain symptom-complexes which in some ways resemble Basedow's disease.

Table of Autointoxications.—In the following we give Senator's concise table of autointoxications:

A. Autointoxication by retention.

Carbonic acid intoxication combined with a decreased intake of oxygen, in obstruction of the air-passages.

B. Autointoxication by resorption:

1. Gastrointestinal phenoluria. In constipation, ileus, and peritonitis.

Diaceturia and acetonuria in digestive disorders and in an excessive supply of fat.

Hydrothionemia.

Tetany?

Pernicious anemia in helminthiasis (anchylostomum, bothriocephalus, etc.)?

2. By resorption from the urinary bladder (cystogenous).

Ammonemia.

Hydrothionemia.

3. By resorption from other cavities.

Phenoluria (indicanuria).

Hydrothionuria.

Rheumatoid affections in bronchiectasis.

A + B. Combined retention and resorption intoxications:

Icterus.

C. Dyscratic or histogenic autointoxications:

1. By plasmolysis: Acidosis (acid intoxication).

2. By nucleolysis (uric acid diathesis).

3. By anomalies of the specific internal secretions.

Morbus Basedowii, cachexia strumipriva, myxedema, diabetes by insufficiency of the pancreas; Addison's disease (adrenal affections); akromegaly (disease of hypophysis?).

A. or B. + C. Dyscratic autointoxication combined with that due to retention and resorption.

Uremia in insufficiency of the kidneys.

Cholemia in insufficiency of the liver.

D. Autointoxications in infectious diseases.

Therapeutical Points of View.—*In Retention.*—According to the nature of the autointoxication, its treatment and prognosis will vary. If the condition is due to retention we may moderate, but not entirely remove the injurious noxæ. CO_2 intoxications would demand, in the first place, the removal of the accumulated gas; as this is usually impossible, we accomplish at least an increase in the simultaneously impaired absorption of oxygen by inhalation of oxygen or by means of compressed air. If at the same time it is possible to increase the exhalation of CO_2, the results will be much more marked, as in intubation in croupous laryngitis and on acceleration of the blood-stream in heart failure with congestion of the auricles.

In Resorption.—On autointoxication due to resorption we strive to remove the toxins and the toxin-producing bacteria from the body, to hinder decomposition processes by disinfectants, and to transform the poisons produced into harmless substances.

With this point of view we wash out the stomach, the intestines, the uterus, and bladder, irrigate cavities and empyemas, and institute drainage in abscesses. To the rinsing fluid we add various disinfectants, and give intestinal and urinary disinfectants internally. In putrid bronchitis, pulmonary gangrene, and bronchiectasis we give turpentine. In some cases we make use of chemical antagonism; thus in ammonemia we wash the bladder with acid solutions, in phenolemia we give sulphuric acids.

In Dyscrasia.—In the dyscratic and histogenic autointoxications a copious supply of alkali will give good results, especially in the presence of acidosis. In the uric acid diathesis the treatment should strive to increase the alkalinity of the blood. Disorders of the internal secretions belong to the domain of organotherapy, which as yet has given satisfactory results only in myxedema and cretinism (with thyroid substance).

"Washing out" of the Organism.—In threatening cases of autointoxication we may perform a venesection, provided the strength of the patient permits it. From 100 to 200 c.c. blood may be removed, followed by the infusion of about 500 c.c. physiological solution. The result is often an immediate one, as in uremia. Elder children also tolerate this proceeding very well. The quantity of

blood taken may be 1/200 of the body weight; thus in a child of 20 kg., 100 c.c. The infusion of physiological salt solution has to be omitted if the object of the blood-letting is to relieve the pulmonary circulation. In the first years of life venesection is not advisable.

Technique of Venesection.—The technique of venesection is the following. Around the upper arm, which hangs passively, an elastic bandage is drawn so tight that the peripheral veins become engorged, but the radial pulse remains unchanged. After careful disinfection, a vein at the bend of the elbow is cut in its longitudinal direction or, if the vein is well marked, it is punctured with a sterile needle.

If leeches are employed it will be remembered that one leech draws out about 10 c.c. of blood and that the same quantity may be removed by stimulating the secondary hemorrhage. This method is insufficient when large quantities of blood are to be removed.

In autointoxication due to retention, such as uremia, the stimulation of vicarious excretion by sweating and laxatives is indicated; and in all forms of autointoxication, a symptomatic treatment of the threatening manifestations, as spasms, coma, etc., without neglect of the above indications.

CHAPTER XIX

SYMPTOMS OF NERVOUS IRRITATION AND PARALYSIS

NERVOUS IRRITATION

Review of the Symptoms of Motor Irritation.—Spasms are symptoms of motor irritation, representing involuntary contractions of the muscles. They may occur suddenly or may remain for a longer period, though with varying intensity, and are thus distinguished as clonic and tonic spasms. They may involve only a single muscle or a group of muscles, but sometimes several portions of the body or the total striated musculature.

Among clonic spasms of special clinical interest are the spasm of the diaphragm (singultus), facial spasm (tic convulsiv), and general convulsions. The convulsions, as well as the singultus, may sometimes assume a threatening character.

Among tonic spasms may be mentioned the painful spasm in single muscles and muscle groups, as cramp in the calf, spasm of the muscles of mastication (trismus), cramp of the erector spinæ (opisthotonus), and the spasm of the whole striated musculature (tetanus). The three last-mentioned conditions are of an eminently dangerous nature.

Mixed forms, consisting of both tonic and clonic spasms, are sometimes observed, as in epilepsy, in Jacksonian epilepsy, in eclampsia, and in uremia.

Short clonic spasms of single muscle bundles without active movements (fibrillar twitching) may be observed in muscles which have become atrophic from a diseased condition in the peripheral neurone (anterior horn, nucleus of a cerebral nerve, and the peripheral nerve). These fibrillar twitchings also occur in traumatic neurosis, especially after slight exertion of the muscle involved. Often, however, due to the effect of cold on undressing or great overexertion, they are of little significance. Here belongs tremor in all its various forms, as that in chronic alcoholism, mercurialism, multiple sclerosis, paralysis agitans, Graves' disease, and other neuroses; it is hereditary in some families and often occurs in old age.

Choreic and athetoid movements accompany various brain processes; they precede or follow monoplegia and represent the chief symptoms in two nervous diseases, sui generis.

Pathogenesis of Spasms.—Spasms develop from irritation of the

motor tracts or ganglia, whether these are more excitable *a priori* (epilepsy) or have been irritated by poisons (uremia, tetanus), or, reflexly, from the periphery.

Spasms are especially easily produced reflexly in infancy and early childhood, where gastrointestinal disorders, parasites, and even a high degree of flatulency are regarded as the cause.

Hiccough (*Singultus*).—Among the peculiar forms of spasm, as far as they are not considered in another chapter, may be first mentioned singultus or hiccough. This clonic spasm of the diaphragm is due to the irritation of the centers for inspiration and not to that of the phrenic nerve. It occurs in nervous and hysterical individuals, and a veritable epidemic of hiccough has been frequently observed in schools. It is brought about in healthy individuals by reflex action, whether from irritation of the gastric mucosa, from a cold drink, on overfilled stomach, as is frequently the case in infants, or from other organs, as uterus, prostate, kidneys, liver, pleura, pericardium, peritoneum, mediastinal tumors, aneurysm, esophageal affection. Anemic and cachectic individuals have a certain disposition to this form of spasm.

Singultus may become very intense and lead even to one hundred spasms in the minute, which causes violent pain at the line of insertion of the diaphragm. By continuing weeks, and even years, it may indeed become a torment to the patient. If severe intestinal or peritoneal affections set in with this symptom, it is a dangerous sign. Lighter cases often respond to slight peripheral irritation, as pressure on the brachial plexus, on the carotid, a cold drink, a cold shower on the neck, or a warm bath followed by the latter. Erb recommends strong faradization of the hypochondria; Eulenburg, galvanization of the phrenic nerves. In obstinate cases respiratory gymnastics may be practised, the patient slowly performing in- and expiration synchronously with the rhythm of a metronome. In hysterical hiccough recovery promptly follows any physical procedure or medication which incites the confidence of the patient. Hiccough due to irritation of the peritoneum will respond to a cooling apparatus on the abdomen or to an injection of morphin.

Convulsions.—A second important group of spasms are the convulsions observed in cerebral hemorrhage, acute anemia of the brain, brain tumors, meningitis, and encephalitis.

Hemorrhage of the brain leads to tonic and clonic spasms, usually unilateral, if the focus is situated in the cortex, but involving the whole body, in hemorrhage into the basal ganglia, cerebellum, or pons, and on perforation of the ventricles or meninges.

Muscular twitching and general convulsions may follow cerebral anemia, due to sudden severe loss of blood. To this group belongs the

so-called hydrocephaloid (Hall's disease), a symptom-complex sometimes seen in infants after a great loss of body fluids.

Tonic Spasm of the Diaphragm.—The tonic spasm of the diaphragm may severely impair respiration. It is observed in epileptic and hysterical attacks, in tetanus, in severe muscular and articular rheumatism, sometimes in tetany and rabies. In combination with spasms of the whole musculature, it may favor the development of a catarrhal pneumonia in the course of tetanus and hydrophobia. Associated with spasms of the muscles of the finer bronchi, the tonic spasm of the diaphragm gives rise to the severe hindrance to respiration in bronchial asthma. The thorax is in the position of inspiration, the epigastrium protrudes, and a sensation of severe oppression exists, together with cyanosis. The lower borders of the lung stand low, acute emphysema develops, the area of cardiac dulness is decreased, and all kinds of wheezing and buzzing sounds are heard on auscultation, if the condition is associated with bronchial asthma. This contracture du diaphragma, as Duchenne described it, may be only unilateral, whereby Litten's phenomenon is then absent on the side involved. The symptoms in this case are not so severe as in the bilateral affection.

Spasm of the diaphragm is best combated by hot baths, cutaneous irritation by sinapism, faradization of the diaphragmatic region and of the abdominal musculature, which act as antagonists, and by injection of morphin. In dangerous cases chloroform anesthesia may be necessary.

Tonic Spasm of the Musculature of the Larynx.—Tonic spasm of the laryngeal musculature may be divided into spasms of the closing muscles of the glottis, which lead to hindrance of respiration, and those of the opening muscles, which render phonation impossible. The first form of spasm may be simulated by a paralysis of the posterior laryngeal nerve (posticus), but the diagnosis may at once be decided by examination with the laryngoscope; the chronic duration of the condition speaks for a paralysis of the posticus, whereas a rapid change speaks for the spastic condition.

Pseudocroup may also simulate a spasm of the closing muscles, and the subjective sensation of a contraction in the larynx with a normal opening of the glottis is sometimes observed in hysterical individuals. But true laryngeal spasm may occur in hysteria, as well as in epilepsy, lyssa, tetanus, and very rarely in chorea minor, and in local affections of the larynx, due to injury, inflammation, foreign bodies, and ulcerative processes. In these cases it may sometimes be checked by cocainization of the larynx.

In children laryngospasm is much more frequent than in adults. Formerly having been related with hyperplasia of the thymus gland

and craniotabes, it is to-day ascribed to tetany (Escherich). Some cases may perhaps be connected with hydrocephalus and microcephaly and others with tubercular glands pressing on the recurrent nerve.

Hysterical Cramps of Respiration.—The hysterical spasms of the respiratory musculature, as singultus, ructus, hysterical coughing, and laryngospasm, are effectually treated by methodical respiratory gymnastics, just as other muscular contractures are improved by methodical exercise.

Spasmodic sneezing, sternutatio spastica, ptarmus, occurs sometimes in whooping-cough, in syphilitic coryza, and in eczematous keratitis on a scrofulous base. It may become so intense and obstinate that the ingestion of food is hindered and the exhaustion becomes threatening. Cutaneous irritation will first be used, cold water being poured over the head; in most severe cases, chloroform anesthesia will have to be given.

Pharyngeal Spasm.—Spasm of the pharynx and esophagus, known as pharyngismus, and œsophagismus, are commonly observed in hysteria, tetanus (hydrophobic tetanus), hydrophobia, and as pharyngeal crises in the course of tabes.

Rabies.—Rabies sets in after slight prodromal symptoms lasting one to three days, during which period the wound becomes painful with short spasms on deglutition and inspiration, followed by severe dyspnea, mortal fear, and an increase of all these symptoms at the sight of water (hydrophobia). As similar symptoms may develop in tetanus and as opisthotonos may occur in rabies, the differential diagnosis is sometimes difficult, but the absence of psychical disorders will speak against rabies and for tetanus. If an hysterical person is bitten by a dog, a symptom-complex may arise which at the first glance could easily be mistaken for rabies. But the absence of fever and collapse and the presence of other stigmata of hysteria will point to the right diagnosis.

The pharyngeal crises of tabes are characterized by rapidly following acts of swallowing.

Cramps of the Calf.—Painful cramps of the calf sometimes occur in healthy individuals after overexertion or cold baths; as a sequela of metabolic and circulatory disorders, such as diabetes, dysentery, cholera, dilatation of the stomach, following extirpation of the thyroid gland; or due to local affections, as sciatica and varices, and in paresis of the peronaeus nerve. In the last two cases they are usually of chronic duration.

Tetanus.—Tetanus is a very dangerous affection characterized by an extreme excitability of the motor centers due to the toxic action of the tetanus bacilli.

According to the port of entry, four different forms of the disease are distinguished:

1. The idiopathic, rheumatic (portal of entry unknown).
2. The traumatic.
3. The puerperal, especially after abortion.
4. Tetanus neonatorum, starting in the umbilical wound.

The infection in the traumatic form occurs on the pollution of a wound with earth. Thus we observed a case after a small injury on the finger which a man acquired on bowling.

The first symptoms are usually a certain stiffness in the neck and in the muscles of mastication. The symptoms increase to such a degree after a short time that the head is pressed backward into the pillow, and owing to the spasm of the masseter muscles the separation of the teeth for even a few millimeters is impossible. The condition begins with trismus, followed by tonic contractions of the muscles of the trunk. The forehead is wrinkled, the angles of the mouth are drawn out and downward, producing the sardonic grin characteristic of the facies tetanica; the trunk assumes various positions with the spasms; bolt upright (orthotonos), bent forward (emprosthotonos), backward (opisthotonos), or sideward (pleurothotonos).

The extremities are usually free from spasms, being involved only at the shoulder and the knee.

Spasms of the diaphragm and of the closers of the glottis lead to severe cyanosis; profuse sweating and exacerbations of the tonic and clonic spasms complete the pitiable picture. Unfortunately for the patient, consciousness is usually retained, and only shortly before death delirium sometimes sets in.

The prognosis to a certain degree depends on the incubation period. The shorter it is, the greater the danger. Statistics show 91 per cent. mortality on early appearance of the first symptoms and 50 per cent. on a late appearance. The differential diagnosis from cerebrospinal meningitis and rheumatism of the cervical and dorsal musculature will scarcely cause any difficulty. Strychnin poisoning is excluded by the complete intermission of the spasms and the involvement of the extremities especially. In pseudotetanus of hysteria the mind is strongly affected, the symptoms vary in their intensity, and the hysterical stigmata, together with the absence of fever, will lead to the right diagnosis. In rabies no trismus is observed.

Facial tetanus (Rose) sometimes offers great diagnostic difficulties. Following an injury of the facial nerve at the stylomastoid foramen, paralysis of this nerve with spasms of deglutition result; the course of the disease is mild but very persistent. The nosological position of this affection is yet uncertain. If the diagnosis is doubtful, the serum from 1 c.c. blood of the patient is injected into a white mouse, which

in twenty-four to twenty-eight hours succumbs with the characteristic symptoms of tetanus.

Tetanus Neonatorum.—Tetanus of the new-born may develop on the first day of life, but also as late as the fourth week; it is especially frequent in negroes, Baginsky believing that this race had a special predisposition for tetanus neonatorum. The first symptoms usually set in at the end of the first week or the beginning of the second. An early diagnosis is important. Fatigue and unrest, distortion of the face, inability to nurse, and later the stiffness of the lower jaw are early symptoms.

Traumatic Tetanus.—The treatment of traumatic tetanus formerly aimed at the removal of the diseased focus by operation. This should still be tried if it can be done without mutilating the patient, but not much can be expected from it.

Careful nursing is very important, and promises success only when performed by a practised hand. The bed should be broad and soft, and the sheets changed only seldom and cautiously. Baths of 35° C. cooled down to 22° C. may be given for fifteen minutes; since the transport to and from the bath impairs the good effects, the permanent bath or warm moist pack is preferable, provided the patient does not sweat too profusely. In pronounced trismus, feeding may offer considerable difficulties. All attempts to overcome the spasm of the masseters by force must be avoided, as they only augment the condition. The patient must be fed with a sound passed through the nose or through an interruption in the teeth. Spasms of deglutition during this procedure may lead to pneumonia by aspiration of food particles. A soft Nélaton catheter should be used, introduced behind the cricoid cartilage. Renvers recommends the following mixture:

500 c.c. milk,
50 gm. milk-sugar,
2 yolks of eggs,
50 c.c. wine.

Rectal and subcutaneous feeding may be tried, which at least will supply the necessary liquids. An infusion of 200 c.c. olive oil may be given. If the patient sweats profusely, either spontaneously or from baths, an abundant amount of liquid must be supplied. As sedatives, opium, morphin, and chloral hydrate may be tried and also sulphate of curare, whose dose must be determined each time before use by the animal experiment. Therefore the curarinum purissimum Merck is preferable, which Penzoldt recommends subcutaneously in doses of 1/2 to 1 mg. *pro dosi*, not more than 2 mg. *pro die*. Physostigmin salicylate may be given internally in doses up to 1 mg., and not

more than 3 mg. *pro die.* In imminent danger to life it may become necessary to arrest the spasms by chloroform anesthesia. There are three tetanus sera, all of which are antitoxic in action:

1. Behring-Knorr.
2. Pasteur.
3. Tizzoni-Cattani.

Five to 10 c.c. are injected subcutaneously. Results can only be expected if the toxins are still circulating in the blood. If they have all become fixed in the nervous system, a lumbar puncture should be made and the serum injected very slowly into the subdural space, not more than 1 to 2 c.c. in a minute. v. Leyden is much in favor of this method, advised by Jacob, as two-thirds of the cases treated in this way ended in recovery.

Tetanus of the new-born is avoided by careful asepsis in the treatment of the umbilical stump, and this prophylaxis is the chief gain in the treatment of this condition. If infection has once occurred, 5 to 10 c.c. antitoxic serum are injected several times a day, but its effect is doubtful. Symptomatically one may give chloral hydrate internally or as an enema.

For the enema:

Rp.	Chloralhydrat.,	.5
	Mucilago salep	60.0
MDS.	To be used in two enemas.	

Trismus.—Trismus is observed not only in tetanus, but also in trigeminal neuralgia, epilepsy, and in focal lesions in the cerebral cortex and pons, in inflammatory processes of the jaws, in chorea minor, hysteria, tetany, and trichiniasis. The symptomatic treatment must provide sufficient nourishment.

Tetany.—We distinguish a tetany of adults and a tetany of children. The first appears idiopathically in certain forms in the spring, attacking especially young men (shoemakers' cramp), or, secondarily, in the course of gastrointestinal affections, acute infectious diseases, and certain nervous disorders, such as exophthalmic goiter, brain tumor; further, in pregnancy, in aplasia and total extirpation of the thyroid gland, and rather rarely after certain intoxications.

As far as the tetany of children is concerned, some authors believe it is never fatal, whereas others have reported death from laryngeal and diaphragmatic spasm. According to the newest investigations of Lundborg and of Erdheim, we probably have to deal with a diseased condition, or an accidental operative removal of the parathyroid glands.

The disease consists chiefly in tonic spasms of the extremities which appear in attacks without any disturbance of consciousness.

In the intervals free from attacks, the paroxysm may be brought on by pressure on the brachial plexus (Trousseau). The galvanic excitability is increased (Benedict, Erb), and the motor as well as the sensory nerves are oversensitive to mechanical irritation (Chvostek).

In regard to the tetany of workmen and in pregnancy, v. Frankl-Hochwart has reported recently as to the fate of his patients: "Chronic tetany, a tetanoid condition, chronic invalidism, and debility usually follow the acute affection."

According to MacCallum and Davidson, the tetany due to parathyroid insufficiency may be healed by organotherapy, fresh parathyroid glands of the sheep being given in the form of emulsion. The tetany of childhood may attack healthy individuals as well as sickly ones, especially rickety children and those suffering from gastrointestinal affections. v. Pirquet found that 28 per cent. of breast-fed children were hypersensitive to the galvanic current; of artificially fed children, 55 per cent. This hypersensitiveness may be proved by the comparison with the normal values of irritation, and by comparing the reaction toward the galvanic stream at the height of the spasm and after its disappearance. The ulnar nerve is very convenient for this mode of examination, the normal kathodic closing contraction appearing on 0.9 to 3.3 MA. The anodic opening contraction and the tetanic contraction on closure is difficult to obtain in adults. The galvanic reaction of infants has been thoroughly studied by Escherich.

v. Pirquet reached the following conclusions from investigation in Escherich's clinic:

1. The galvanic examination of normal infants gives closing contractions only with a current strength below 5 MA.

2. The appearance of the anodic opening contraction below this current strength, together with the absence of the kathodic opening contractions and tetanic contractions on closing the kathode, characterizes a slight overexcitability, which may be designated as "anodic overexcitability."

3. The latter is inferior to the kathodic excitability, which is recognized by the appearance of a tetanic contraction on opening the kathode, with a current under 5 MA.

The treatment will aim to improve the primary condition in secondary tetany. Gastrointestinal symptoms must be combated by lavage, tetania strumipriva (recte parathyreopriva) by the administration of parathyroid tablets, and rickets by the phosphorus cod-liver-oil medication.

For the symptomatic treatment we may use morphin, chloral hydrate, wrapping the extremities in wet bandages, galvanization of the spinal cord and of the extremities with a weak current, and faradization.

Tenesmus.—Other painful spastic conditions are the spasm of the anal sphincter occurring in affections of the rectum, as anal fissure, hemorrhoids, prolapse, cicatricial stricture, syphilis, etc., and the spasm of the sphincter of the bladder, common in affections of the bladder, and in nervous diseases. Any lesion in the nerve supply of the bladder above its center in the lumbar cord may lead to retention of urine from irritation of the sphincter muscle, or from inhibition of the detrusor. Winternitz recommends a bag for the rectum, filled with warm water, as very beneficial in stranguria and tenesmus.

Pseudotetanus.—As pseudotetanus, Escherich described a disease which was characterized by a stiffness of the body, spreading from the feet upward, the arms and hands remaining unaffected. The condition is exacerbated by irritation; symptoms of tetany (Trousseau, Erb, Chvostek) are absent, and complete recovery results, usually within a few weeks. In the differential diagnosis the spastic hemi- and diplegia of porencephalia have to be considered; this latter, in its further course, leads to idiocy, disturbances of speech, and epilepsy.

Nodding Spasm.—By spasmus nutans we understand rhythmical contractions of the sternocleidomastoid muscles, which produce nodding movements of the head, combined with nystagmus. These movements persist during sleep, and on absence of light; they may be explained, like the nystagmus of miners, by the fact that from infancy these children have fixed their eyes on a light point in their dark rooms. If the head is fixed the nystagmus is increased at first, but tends to disappear later on. In this way recovery has been brought about by Demme through the use of a wire basket which maintained the head in one position. Caillé brought about improvement by bandaging the eyes from the light. Rickety children and those during dentition are predisposed to the condition. Other pathogenetic factors are irritation by worms, dyspepsia, trauma, and rheumatic affections. This harmless condition, healing in a few weeks, has no connection with the symptomatic saluting spasms known as "salaam spasm" in which the children bow deeply with the head and trunk, but no nystagmus is present. This clonic spasm is associated with disturbance of intelligence and epileptiform attacks, and leads generally to idiocy or death. Willshire suspects here a diseased condition of the basal ganglia. All treatment is hopeless; myotomy and neurectomy of the accessorius have been tried, but without success. In the treatment of the above-mentioned benign nodding spasm, it will be found sufficient to bring the children into a dwelling with plenty of light, and in rickety children to prescribe phosphorus cod-liver oil.

General Treatment of Cramps.—In organic as well as in functional nervous disorders which lead to spasm the physical methods of treatment offer favorable results if rightly applied. Electrotherapy may

be performed with the galvanic as well as with the faradic current. The brain is treated with very weak galvanic currents in the sagittal, oblique, or transverse direction. Strong currents lead to unpleasant symptoms, lightning flashes in the eyes, and galvanic vertigo. The anode usually has a quieting effect, the kathode an irritating; therefore the anode will be applied to the points which evoke the spasms. The same is true of the spinal cord, through which the current is passed in the direction of the neck toward the lumbar region or *vice versa*. The muscles attacked may be treated with the anode, and with increasing faradic currents.

Cold baths on the back of the head, a fan douche on the feet, and a Scotch douche on the spastic members are recommended in cerebral contractures; in spinal affection, a vertebral cooling apparatus; and in any cramp-like condition, warm protracted baths at thermal springs, and brine baths.

The American physicians in recent times introduced a new symptomatic treatment of spasms, "eleomyenchisis;" a fat mixture which solidifies readily is injected into the contracted muscles; the limb is placed in the position of muscular relaxation and the injected fat is solidified by the cooling effect of an ether spray. In this way a sort of internal immobilization is produced, which is believed to be more effective than the common method by splints. In desperate cases, surgical intervention may become necessary to remove a foreign body or excise a scar which presses on a nerve, to perform the bloody or bloodless stretching, section or resection of a nerve. By this operation paralysis takes the place of the spasm; if the conduction of the nerve is regained, the spasm may reappear.

Beside the older well-known remedies of antispastic action, as bromids, valerian, opium, and chloral hydrate, two newer drugs have come into use, whose application requires great care. Pure curare in the dose of 1/2 to 1 mg., with a maximal dose of 2 mg. *pro die*, and the hydrobromid of coniin, in subcutaneous injection, up to 2 mg. *pro die*, in adults.

In hysterical conditions of excitation affecting the motor apparatus, as well as in occupational neuroses with spastic symptoms, the exercise treatment of Frenkel may be helpful in enabling the patient, at first with the aid of splints, to relearn the inhibited movement. Suggestive and gymnastic therapy may also be valuable.

Chorea Minor.—Chorea minor, the most common neurosis of childhood and adolescence, only in rare and severe cases assumes a threatening character. Then deglutition is impaired, an aspiration pneumonia may develop, asphyxia from the disturbance of respiration, and exhaustion from the excessive motor unrest. In these severe cases feeding is of the utmost importance. Milk should be supplied abun-

dantly by means of a beaked cup, pure or mixed with nutrient preparations; if this is not possible, the nourishment must be supplied by means of sounds or per rectum. Gowers advocates mild hydropathic procedures and sweat cures, static electricity on the head, descending galvanization of the spinal cord, 3 to 5 MA. for ten minutes, effleurage of the whole body, and resistance gymnastics.

If the chorea appears to be of rheumatic origin, the salicylates and antipyrin may be given in large doses; pills of arsenic acid, 0.0005 gm. to 0.001 *pro dosi*, two to three times a day, or

Rp. Solut. Fowleri, 2.0 g.
Aq. menth. piperit., 6.0
DS. One to twelve drops and more, three times a day.

The treatment is started with 1 drop three times a day, the second day 2 drops are given three times, and in this way 1 drop is added each day until 12 drops are given three times a day. Then each day 1 drop is omitted until 1 drop is given.

The bromate of camphor has been recommended by Baccelli in daily doses of 1 to 1.5 gm.

In severe chorea, mattresses should be laid on the floor to protect the patient from self-inflicted injury, and large doses of bromids, morphin, and chloral hydrate should be given; great precaution must be exercised if there is tendency to collapse. Strümpell considers chloroform anesthesia unnecessary. Of an especially threatening nature may be the chorea of pregnancy, in which severe psychoses, perturbations, hallucinations, and delirium may develop. If the above-mentioned measures are found insufficient, premature abortion must often be induced to save life. Of a less violent, but constantly unfavorable course, is Huntington's chorea, a chronic form of the disease which develops in adults and ends in idiocy. Medical gymnastics, galvanization, and warm baths may be tried.

Paralysis Agitans.—Another disease, pursuing a chronic course, which usually begins after the fourth decade of life, is paralysis agitans. It is characterized by a slow tremor, especially of the fingers, which is more marked on rest than on voluntary movement, during which it may, indeed, entirely vanish. The rigid expression of the face and the stiff attitude of the body are characteristic symptoms. Erb recommends the injection of the hydrobromate of hyoscin in doses of 1/10 to 1/2 mg., at which latter dose symptoms of intoxication, as vertigo and weakness, may be observed; also duboisin in doses of 0.0002 to 0.0003 gm., may be injected. Bromids and arsenic may also give relief. The observation that concussion, as driving on a rough road, is very well tolerated by the patient caused Charcot to

recommend a vibration chair in which the patient was shaken for a quarter of an hour every day. The success was not, however, entirely satisfactory.

PARALYSES

General Review of Paralyses.—We distinguish between paralysis and paresis; we speak of paralysis if an intended movement cannot be performed at all; of paresis if it cannot be performed with the normal strength and rapidity, or not to the normal extent. Paralysis may sometimes be simulated by mechanical hindrances in the articulations, or by a psychical inhibition from pain, of which the patient is not conscious. Such errors occur especially in childhood in severe rickets, Barlow's disease, and syphilitic osteochondritis (Parrot's pseudoparalysis).

Examination by Means of the Electric Current.—The diagnosis of the seat of paralysis and the prognosis of its duration can often only be made by the examination with the electric current. An entirely normal reaction is found above all in hysterical paralyses, a simple decrease of excitability or a normal reaction in all lesions of the motor tracts in the brain and cord, with the exception of the anterior horn. Diseases of the anterior horn and of the peripheral nerves produce a qualitative change in irritability, the reaction of degeneration. A lowered electric irritability of nerves and muscles occurs in any recent peripheral paralysis. If it is of a severe nature, the reaction of degeneration may be demonstrated even after a few days. The galvanic irritability of the muscles increases, the contraction is sluggish, however, the anodic closing contraction develops more readily than the kathodic, and is stronger, the same strength of current being employed. In those peripheral paralyses which do not increase from the presence of a persistent noxa, as the presence of a tumor, the absence of the reaction of degeneration for about two weeks signifies a favorable prognosis. If a partial reaction of degeneration appears the recovery may take months. If after six months the irritability of the muscle to the galvanic stream has become less, the outlook is bad, whereas an increase of irritability favors the prognosis.

Polyneuritis and the paralysis of lead poisoning occupy a peculiar position. These, in severe cases, may lead to great reduction in irritability to any kind of stimulus, without the reaction of degeneration, because the muscle fibers, as well as the nerves, have been injured. Experience shows that this phenomenon, in the diseases in question, has not the same unfavorable prognosis as in other forms of peripheral paralysis, and any small improvement is a weighty factor, since here, as in postdiphtheric paralysis, the recovery is usually complete if improvement once begins.

It is just the opposite in acute anterior poliomyelitis, in which the muscles which show the reaction of degeneration are lost forever, and only the absence of this reaction in the third week will permit a favorable prognosis. A simple reduction of the irritability occurs also in primary progressive myopathy and in those spinal and neurotic atrophies where the injured portion of the nerves and muscle fibers degenerate rapidly, while the remaining portions are in fact healthy. It is not possible to discuss the diagnosis of paralysis here. It must first be our object to gain a complete knowledge of the status of the nervous functions, and then, having made the topical diagnosis of the lesion, we have to seek for the nature of the morbid process.

General Treatment of Paralysis.—If the etiology furnishes a therapeutic indication, this must first be fulfilled, as in syphilis, malaria, diabetes, and in intoxications with alcohol, lead, and arsenic. In neuritis of infectious origin the salicylates are sometimes beneficial. If pressure from some bone fragments, callus, tumors, abscess, or hemorrhage injures the nerve, it has to be removed by surgical intervention. Injuries of nerves, severing their continuity, demand the performance of nerve-suture as quickly as possible, as any loss of time is heavily paid for in the great difficulties of secondary nerve suture. It is advisable to treat the paralyzed muscles and nerves with the faradic stream, and to use a weaker current for the nerve than for the muscle. It is not necessary to obtain contractions. When the treatment has been regularly carried out for a week, the irritability of the nerve is so increased that the lower limit of stimulus is reached much earlier than previously. Contraction favors the metabolism and circulation of the muscle.

In peripheral paralysis it is advisable to treat the nerve centrally from the point of the lesion, with a constant stream in the descending direction, the kathode being applied near the lesion (Erb). In some cases, as in affections of the facial nerve, in the Fallopian canal, this may be impossible, as the nerve can only be reached peripherally to the place of lesion. This mode of application also gives excellent results sometimes. Erb advises the application of the labile kathodes peripherally.

The stimulating action of the galvanic stream may be increased by interruption and reversion of the current. Severe forms of paralysis can scarcely be influenced by electrotherapy. The galvanic current should be tried first, and only when the irritability indicates progress in the process of regeneration may one try to hasten it by repeated faradization. The spark machine may be used in the same way as the induction apparatus. DeWattville recommended a combination of the galvanic and faradic currents, galvano-faradization. We must

caution against the too early use of electricity in recent polyneuritis and myelitis.

The central nervous system may be treated with a weak, constant stream, without interruption and reversion; the diseased focus should be included in the circuit. In progressive bulbar paralysis, the electrodes are applied on both mastoid processes and a current of at least 2 MA. is transmitted transversely. Indifferent warm baths, brine baths, and those rich in CO_2 are sometimes beneficial. Brine baths of a temperature of 32° to 34° C. are given for fifteen to thirty minutes every second day. They may be prepared artificially by the addition of natural brine, containing 30 to 40 per cent. salt, or of rock salt, of which 3 to 9 kg. are used to prepare a bath containing 1 to 3 per cent. of salt, for an adult.

In toxic and infectious paralysis, the wet pack for an hour, followed by a cold rub, the steam, hot-air, and electric-light bath, may be used, and if the heart is involved, as in postdiphtheric paralysis, quick half-baths and CO_2 baths.

In hysterical paralysis, shower and plunge baths, rubs, and the faradic brush will be indicated. All unpleasant procedures have a prompt suggestive action. Thus hysterical aphonia may disappear at once on endolaryngeal galvanization.

Gymnastics and massage gain constantly in importance. Very ingenious is the method of Goldscheider, which increases the force of movement by the use of bandages which are applied to the paralyzed limb like reins. The kinetotherapeutic baths accomplish the same results. The patient, sitting in a roomy bath-tub filled with warm water, performs his exercises with much less exertion. The treatment with methodical exercises, introduced by Frenkel, acts by working out new paths in paralysis, in which irritation, co-movements of the healthy extremities, and passive motion are used.

Of medicaments, iron preparations, quinin, potassium iodid, and strychnin nitrate are often given. The last is of doubtful effect, but may be tried in doses of 1 to 3 mg. Older children are given 5 drops of the tincture of strychnin, two to three times a day. Strychnin nitrate may also be given subcutaneously in children with postdiphtheric paralysis, as follows:

3 years,	0.0005 gm.
5 years,	0.001 gm.
10 years,	0.002 gm.

In diseases of the nervous system due to chronic alcoholism, one may be quite free in the dosage of strychnin. Stintzing gives 0.002 to 0.005 gm. every second day, in gradually increasing doses. If an

incurable paralysis leads to deformity by contracture of the antagonistic muscles, orthopedic surgery may offer valuable service.

Some forms of paralysis deserve special consideration on account of their life-threatening significance.

Paralysis of the Diaphragm.—Especially dangerous is paralysis of the diaphragm. It is characterized by the fact that the lower borders of the lungs stand high, and that the epigastrium does not protrude on inspiration, but sinks inward. The type of respiration is purely costal. The inferior portions of the lungs become atelectatic; hypostatic pneumonia may develop, and is the more dangerous, as only a very weak cough is possible. Since the function of the diaphragm is absent, vomiting and defecation are much impaired.

Occurrence.—Paralysis of the diaphragm occurs in caries of the cervical vertebræ with compression of the phrenic nerves; further, in postdiphtheric paralysis, in alcoholic neuritis, lead intoxication, hysteria, in Landry's paralysis, progressive muscular atrophy, tabes, in rare cases of rheumatic paralysis, in inflammation of the pleural or peritoneal layers of the diaphragm, and in trichinosis. It is further a manifestation in the symptom-complex of bulbar paralyses, such as in amyotrophic lateral sclerosis, chronic progressive bulbar paralysis, bulbar myelitis, and hemorrhage, as well as in embolism and thrombosis in the medulla oblongata; further, in polyneuritis, in spinal progressive muscular atrophy, and in syringomyelia toward the fatal end. It is, however, constantly absent in the progressive muscular dystrophy of Erb.

Treatment.—In the symptomatic treatment of diaphragmatic paralysis, we must care for an easy defecation and must give the most careful attention to the slightest bronchitis. We may try rhythmical irritation of the phrenic nerve, synchronous with the respiratory movements. For this we apply the indifferent electrode on the sternum while the other is pressed deep against the vertebral column at the posterior margin of the sternocleidomastoid, three fingers' breadth above its point of insertion. If irritability is lost for the induced current, we apply the anode to the neck and the kathode to the point to be stimulated, and allow a constant current of 4 MA. to pass for four minutes. Injections of strychnin, arsenic, and cold rubs will be found helpful.

Paralysis of Deglutition.—Of great importance is the paralysis of deglutition, whether it follows faucial diphtheria as a postinfectious paralysis, or whether, combined with a paralysis of the vagus and hypoglossus, it results from a disease in the pons and medulla oblongata. Also pseudobulbar paralysis, in which the diseased focus is not in the medulla but in the cerebrum, and neuritis of the vagus may lead to paralysis of deglutition.

The hysterical hydrophobia is a spasm of deglutition which, too, is associated with the inability to swallow. In the nervous paralysis of the esophagus large masses of food are passed more readily than small ones and liquids. A very rare cause of paralysis of deglutition is trichinosis.

Esophageal Paralysis.—Paralysis of the esophagus may exist independently of that of deglutition, as that following diphtheria, in lead poisoning, chronic alcoholism, syphilis, apoplexy toward the end, bulbar paralysis, tabes, and multiple sclerosis. It may sometimes be observed that liquids pass into the stomach with a loud rumbling sound (dysphagia sonora); firm masses of food stick fast more easily if the patient is in a horizontal position than in a standing. The danger of choking may sometimes be avoided by giving the head a certain position during the act of swallowing. It may be found advantageous to bend the head strongly backward or to hold it on one side or to bend it forward with the chin on the chest. Liquids are best taken through a glass tube. Feeding by means of the stomach-tube is sometimes not entirely free from danger; for in the paralysis of the superior laryngeal nerve, which, however, is not very frequent, and in paralysis of the epiglottis on anesthesia of the laryngeal mucosa, the tube may be passed into the aerial passages by an inexperienced operator. Galvanization of the medulla oblongata and the production of movements of deglutition by closure of the kathode and by strychnin will help to further the regeneration of the injured nervous fibers.

Paralysis of the Vagus.—The recognition of vagus paralysis is essential; it occurs intracranially during basal meningitis, syphilitic diseases of the meninges, in tumors of the cerebral membranes and of the bones of the base of the skull, and in aneurysm of the vertebral artery. In its peripheral course, the nerve may be injured by caries of the vertebræ, aneurysm, and glandular tumors of the neck, trauma and pleural induration, and by poisons, as lead and phosphorus, and by toxins, as in diphtheria and typhoid, fevers. In bulbar paralysis and in tabes, the vagus may become paralyzed, producing laryngeal crises. A peculiar dyspnea develops, followed by an acute emphysema of the lungs and cardiac asthma. The vocal cords may be paralyzed, as in the paralysis of the recurrent nerve. A high degree of tachycardia exists as the inhibitory action on the heart is absent, and there is a tendency to vomiting in the first few days after the injury of the vagus. v. Ziemssen recommends passing strong galvanic currents from the thoracic vertebræ to the heart and making from seventy to eighty reversions in the minute, to stimulate the enervation of the heart. It is advisable also to regulate respiration by the rhythmical faradization of the phrenic nerves; Erb emphasizes that care should

be exercised not to cause contraction in the abdominal muscles, as they are the antagonists of the diaphragm.

Paralysis of the Laryngeal Muscles.—*Paralysis of the Recurrent Laryngeal Nerve.*—Paralysis of the recurrent nerve causes dyspnea only in very small children, where, on account of the restricted space, both vocal cords are then in postmortem position. In adults the danger lies in the impossibility of coughing, as the explosion presupposes a previous prompt closure of the cords. If the paralysis of the recurrent is unilateral, complete closure of the rima on coughing and phonation may be brought about by the compensatory overlapping of the healthy cord.

Paralysis of the Posticus.—Whereas the paralysis of the adductors hinders only phonation, paralysis of the posticus is accompanied by the severest inspiratory dyspnea and stridor, but expiration is unimpaired. It may initiate a paralysis of the recurrent or accompany all processes which cause an injury of the inferior laryngeal nerve in its long course (lung and pleural processes, aneurysm). Inflammation and foreign bodies in the larynx, chronic intoxication with arsenic and lead, and the action of toxins, as in typhoid fever, diphtheria, and influenza, and very rarely rheumatic noxæ may be the pathogenic factor of the threatening symptom. Brain processes produce only a unilateral paralysis of the posticus, which therefore is less significant. In some cases, by electric treatment, it may be possible again to stimulate the function of the muscle with the electrode applied to the thyroid cartilage. In desperate cases, intubation or tracheotomy may become necessary to save life.

Paralysis of the Bladder.—Paralysis of the bladder caused by an affection of the conus medullaris or the cauda equina is entirely atonic, the urine oozes continually but cannot be passed in a jet. It is usually associated with incontinence of the stool.

Paralysis Acquired during Birth.—As far as paralysis acquired intrapartum is concerned, not only the labor by forceps, but also the spontaneous labor may lead to paralysis of the facial nerve. Such a peripheral paralysis often heals within four weeks, the orbicularis muscle regaining its function much earlier than the muscles supplied by the lower facial. If no spontaneous improvement has appeared at the end of the second week, one may begin the use of the faradic current. In lagophthalmus, the eye must be protected against keratitis by a moist bandage. If in a breech position the manual assistance is too violent, severe paralysis may be produced by lesion of the spinal cord and motor nerves; sometimes paralysis of an arm with simultaneous loosening of the epiphysis. The same injury may be produced on using the Prague method of delivering the aftercoming head.

Symptoms of Sensory Irritation.—*Neuralgia.*—Of symptoms of sensory irritation, the neuralgias are, above all, important. These are very violent attacks of pain which are limited to the region of a certain nerve. Pain on pressure, strictly localized at certain points, leads to diagnosis in the intervals free from pain (Valleix' points douloureux). The causes of neuralgia are various. A certain inherited disposition is probably necessary; trauma and rheumatism may act as inciting factors; pressure from fractures, luxations, ostitis, and periostitis, other inflammations, tumors, aneurysm, varices, fecal impaction, hernia (as hernia obturatoria); also poisons, as lead, mercury, arsenic; infections, as malaria, influenza, typhoid, syphilis, producing chiefly trigeminal, occiptal, and intercostal neuralgias; finally anomalies of metabolism, as the uric acid diathesis, diabetes, and anemia, and affections of the brain, spinal cord, ears, eyes, and nose may cause neuralgia.

Therapeutic measures in the treatment of neuralgia are very numerous. The application of the anode, 2 to 5 MA. for one to two minutes, and of the faradic brush; further, static electricity, massage, bloody and bloodless stretching of the nerve, perineural infiltration by the single injection of physiological salt solution, application of ice, freezing the skin by methyl chlorid, ethyl chlorid, carbon bisulphid, carbon dioxid, Paquelin cautery, and warm and hot baths.

In malaria, but also in neuralgia of another etiology, quinin and arsenic, in pills or in subcutaneous injection, are of excellent service:

Rp. Liq. Kalii arsenicosi 1.0
Aq. destill. 2.0
1/4 to 1/2 cc. one to two times a day.

Further, Levico- or Roncegno-water, oil of turpentine, 5 to 20 drops several times a day, and salicylate preparations:

Antipyrin in doses of 1.0.
Pyramidon, 0.3 to 0.5.
Phenacetin, 0.25 to 0.5.
Exalgen, 0.25.
Analgen, 0.5.
Laktophenin, 0.5 to 1.0.
Salipyrin, 1.0.

In cases where all these medicaments fail a morphin injection, beginning with 5 mg., or an atropin injection of 1/4 to 1/2 mg. may be given.

In obstinate insomnia:
Chloralhydrat, 1.0 to 1.5 gm.
Veronal, up to 0.5 gm.
Bromnatrium, up to 3.0 gm.

The painful limb must be kept entirely quiet; in some cases, suggestion and hypnosis must be resorted to.

Paresthesia in the intercostal nerves, the girdle sensation, and the lancinating pains of tabes have to be distinguished from true neuralgia. The treatment is the same as in neuralgia. In some cases the moist, warm pack of the legs is found effective in the lancinating pains. Pain in the nerves, not neuralgia in the stricter sense, is a symptom of differential diagnostic value sometimes. Thus pain limited to a paralyzed extremity, in which the paralysis developed rapidly, speaks against the diagnosis of poliomyelitis and renders that of neuritis probable. Patients may have violent pain in an anesthetic region of the skin, especially in severe lesions of the trigeminal nerve, when the conduction is interrupted and the fibers central to the point of lesion are irritated and produce the sensation of pain, which then progresses toward the periphery (anesthesia dolorosa).

Anesthesia.—Anesthesia is a symptom usually little observed by the patient. There may be a diminished or completely absent perception of all qualities of sensation or of some portion of them (pressure, pain, temperature sense). In peripheral anesthesias this partial loss of sensation is found only rarely, namely, if in neuritis a partial degeneration of the nerve fibers has developed. In the cerebral and spinal it is, however, very frequent. Thus tabetic arthropathy is sometimes associated with complete analgesia, whereas otherwise the sensibility is normally preserved. Indeed, the absence of pain, that guard of integrity, has been blamed as the origin of this articular process. In affections of Clark's columns (poliomyelitis posterior) disturbances of the sensations of heat and pain are regularly present, while the tactile sensation has suffered little or not at all.

In syringomyelia the thermo-anesthetic and the analgesic zones involve chiefly the regions of the neck and of the upper extremities. This leads readily to paronychia and even to the loss of the terminal phalanx, the mutilated hands reminding one of certain forms of leprosy. With the sensory disorders and anesthesia, but also without them, analgesic zones may be present in hysteria and traumatic neurosis, which give the impression of a psychogenous disorder, because their extent is not coincident with the distribution of the branches of cutaneous nerves. Their regional boundaries are not physiological, but geometrical, and islands of normal sensibility may sometimes be found within them.

In affections of the optic thalamus, crossed anesthesias may be observed, which are not only to be explained by an involvement of the internal capsule, but by the fact that fibers of the fillet radiate into the thalamus.

Peripheral and Central Anesthesia.—The following observations will help to distinguish the peripheral from the central anesthesia:

1. Peripheral anesthesia is usually, or at least often, associated with motor manifestations of the affected nerve.

2. It leads to a diminution in, or absence of, the cutaneous and tendon reflexes.

3. It involves almost constantly all qualities of sensation.

4. It corresponds to the region of a certain cutaneous nerve. Anesthesia of the palm of the hand and of the sole of the foot is a very annoying symptom, especially the latter symptom if it involves both feet, as great insecurity is felt on standing with eyes closed (Romberg). Anesthesia may also lead to atactic disturbances.

Treatment of Anesthesia.—The treatment aims to restore the consciousness of sensation to regio s which have lost it by the use of strong stimuli. This is best accomplished by the faradic brush, cold douches, and irritating treatments. The success will be prompt only in hysteria, but in organic diseases good results are often observed from faradization.

Sensorial Anesthesia.—In considering sensorial anesthesia it would lead us too far to take up blindness and deafness due to organic diseases in the respective sense organs or in their nerve conduction. We wish only to point out the great importance of specialistic examination for the diagnosis of brain and general affections, as, for instance, the ophthalmoscopic examination in nephritis, diabetes, brain pressure, miliary tuberculosis, etc. Hysterical deafness and blindness are not infrequently observed, especially on one side, and may be healed by an appropriate psychotherapy. The prognosis as far as the single symptom is concerned is usually favorable, though the tendency to relapses or to other manifestations remains.

Smell.—Anosmia, if bilateral, announces itself by a change in the perception of taste. If local processes in the nose may be excluded, which hinder odoriferous substances reaching the olfactory nerve, disease of the end apparatus from rhinitis, affections of the lamina cribrosa, and of the base of the brain and skull have to be considered in the differential diagnosis.

Anosmia, but more frequently parosmia and hyperesthesia, occur in hysteria, psychoses, and epilepsy. The epileptic aura may consist in hallucinations of odor.

One may try to increase or to lower the irritability of the olfactory nerve by strychnin or cocain, but beside this one must treat the primary conditions.

Taste.—The disturbance of taste must always be tested by sweet and bitter substances, as salty or acid substances also irritate the sensory portion of the trigeminus. The posterior part of the tongue

is supplied by the glosso-pharyngeal, as nerve of taste, which only rarely, as in bulbar paralysis, becomes affected. The anterior two-thirds of the tongue are supplied by the chorda tympani, and thus symptoms on the part of the trigeminal and facial nerves are often associated with the disorders of taste. The lingual nerve contains some fibers for taste and the chorda tympani accompanies the facial nerve for some distance. On lesions of the uncinate gyrus, disorders of taste must be expected. Parageusia is frequent in hysterical and neurasthenic individuals, as aura in epileptics, and in the course of otitis, by way of the chorda tympani. Many mentally affected persons complain of unusual sensations of taste. It has been repeatedly stated that rickety children are hypersensitive in regard to taste, but this remains a question still undecided. For the hysterical disturbances of taste faradization is advisable, and for the unpleasant parageusia, the chewing of gymnema leaves (Oefele).

CHAPTER XX

HEADACHE

HEADACHE SOMETIMES A SYMPTOM OF GRAVE SIGNIFICANCE

A great number of diseases are associated with painful sensations in the head which, for the present, we may comprise under the name "headache." Only in a small number of cases do we have to deal with a severe condition, which then usually shows other symptoms of importance. Headache is often the cause which brings the patient to the physician, leading frequently to the discovery of a disease entirely unsuspected by the patient. Thus in chronic nephritis and in diabetes it may be the only symptom of an obscure disease. In any case of obstinate or severe headache, a careful examination of the patient and of his urine will be indicated.

DIFFERENT PAINFUL AFFECTIONS OF THE HEAD CALLED HEADACHE

A series of painful conditions which impress the patient as headache proves on close examination to be neuralgia, toothache, earache, empyema of the accessory sinuses, rheumatism of the muscles of the head (galea aponeurotica), etc.

"TRUE" HEADACHE AND ITS THEORETICAL EXPLANATION

From all these affections we must separate "true" headache, though it is no morbid entity. Headache originates under the influence of noxæ which produce changes as yet unknown in the nerves of the dura and perhaps in some of the pia. It is, of course, perceived in the cerebral cortex, which can be designated as the place of origin of headache with as little right as that of other pains.

The next question is, how are these nerves stimulated, and what is an adequate stimulus? Not every stimulus, perhaps, is known as yet, but at least two are, anemia and hyperemia, whether congestive or passive. There are numerous clinical examples of it; thus the use of amyl nitrite may cause a flexionary hyperemia with headache; again, heart failure, in the stage of compensatory disturbance is accompanied by frequent painful headaches. Indeed, it may be incited by transient increase of pressure and passive congestion in

an attack of whooping-cough. As for anemic headache, daily observation speaks for the fact that persons suffering from blood diseases feel relieved immediately if placed in a horizontal position. Moreover, it cannot be excluded that in all the other forms of headache, or at least in a great part of them, as the pain in brain pressure and that of infectious, toxic, and autointoxic condition, the pain-perceiving fibers of the dura may be irritated by anemia and hyperemia.

With the exception of a few ramifications of the upper cervical nerves, the region of the trigeminus alone is involved in all forms of headache. Whether these nerves are irritated in their peripheral course, in their ganglia, or in their roots, the pain is constantly projected to the region of their peripheral ramification, in the dura, and is there felt as headache. As to the point of irritation of the nerve, clinical experience teaches that the intracerebral portion of a nerve is scarcely ever so irritated as to cause pain. Sensory tracts in the brain lie very close together; a sensation of pain restricted to the head can no more be caused by such a lesion, for instance, in the internal capsule, than, *e.g.*, monoplegia. Monoplegia develops only peripherally, and the same is true of headache, which never is associated with pain in half of the body.

The necessary supposition for the development of headache by the irritation of a cortical area would be the existence of a cortical area which would only take up trigeminal fibers from the vault of the cranium; for headache is scarcely ever associated with a neuralgia of all branches of the trigeminus. The existence of such an area in the cortex which would correspond only to the dural nerves is by no means proved. Not even the roots, the Gasserian ganglion, or the chief branches of the trigeminal nerves can be considered as the source of the headache, since irritation in these parts does not exist, and therefore only the cutaneous and dural branches remain as points of attack for the noxæ of cephalalgia (L. Edinger). In many affections of the brain and of its membranes, as tumor, abscess, syphilitic or tubercular processes, the cranium is sensitive to percussion. If the meninges are involved the sensitiveness will be more diffuse; if the brain, more circumscribed. In headache of other etiology, infectious diseases, autointoxication, arteriosclerosis, uremia, this symptom will be completely absent. It may serve to differentiate between the genuine and Jacksonian epilepsy, as it is only found in the latter.

KINDS OF HEADACHE

We distinguish the following forms of headache according to etiology and localization:

1. Cutaneous.
2. Rheumatic.

3. Neuralgic.
4. Periosteal.
5. Migraine.
6. Symptomatic migraine.
7. From organic affections.
8. From functional disorders.
9. Toxic.
10. Infectious.
11. From constitutional diseases.
12. From affections of the nose, eyes, teeth, and ears.
13. Traumatic.
14. Reflex.
15. "Idiopathic."

Cutaneous.—The portion of the head covered with the hair is rich in pain-perceiving fibers. The tenderness of the scalp, often felt in a disagreeable way on brushing the hair, is explained by the irritation of the nerve plexi surrounding the hair follicles. This painful sensation, localized in the scalp, has no special significance, and only rarely attains a severer character. It occurs after a wakeful night, after alcoholic excesses, and as a symptom of the general hypersensibility of neurasthenics (*mal aux cheveux*).

Head's Zones.—From this diffuse sensation of pain differ the hyperalgesic zones, whose diagnostic significance has been emphasized by Head. He explains them by the springing of a sensory stimulus, originating in a deep-lying organ, over to a neighboring sensory tract; this stimulus is of such a nature that, while transmitting no painful sensation from the corresponding portion of the skin to the consciousness, it yet produces a state of irritation in the periphery, which finds its expression in hyperalgesia. Head's findings, though not absolutely reliable, are sometimes quite useful.

Hyperalgesia is felt as a sensation of pain, if we lift a fold of the skin or scratch it with the head of a pin; laterally from the glabella, in affections of the eyes, nose, and upper incisors; in the middle of the orbital ridge and above it on the forehead, in hypermetropia; over the external orbital margin and on the crown of the head, in ear affection; over the temples in glaucoma; on the crown of the head, in stomach affections; laterally from the external protuberance, in certain affections of the posterior part of the larynx.

Children after the sixth year of life may show typically developed hyperalgesia.

Rheumatic.—Many cases of obstinate cephalalgia persisting for years with constant relapses are nothing else than a chronic rheumatic myositis, beginning acutely or from the first insidiously; it may lead to the formation of muscular callosities. These may be superficial

or deep-sitting and even involve the periosteum. The points of predilection are the insertion of the muscles, as that of the occipital, the cucullaris, the sternocleidomastoid, the splenii, the deep muscles of the neck, and of the galea aponeurotica.

The whole cranium and the neck are involved in a spontaneous violent pain, which, on movement or on palpation, becomes quite intolerable. Also the spinal processes of the superior cervical vertebræ may be very sensitive to pressure, their periosteum being involved.

The prognosis *quo ad vitam* is good, and the treatment is followed by success in those cases where an exact diagnosis permits the execution of rational measures. In acute cases meningitis may cause difficulties in the diagnosis if stiffness of the neck occurs. But fever, vomiting, and constipation are usually absent, together with the bradycardia and Kernig's symptom. Against migraine speak the absence of the aura, and, beside other factors, the previous history which makes no report of similar attacks from early youth.

The treatment of the acute attack and of an acute exacerbation of the chronic affection is antirheumatic. Steam baths, warm compresses on the head and neck, or the application of thermophores work very beneficially, as well as the administration of sodium salicylate in large doses, or aspirin, salophen, etc. In the chronic course patients must be warned against taking cold; if they are bald they should wear a wig and at night a cap. After being washed, the hair, especially in women, must be thoroughly dried. When the acute manifestations have ceased, massage may be introduced; this is at first very painful and should consist only in a delicate effleurage, but later on the insertions of the muscles and the callosities may be forcefully kneaded. This treatment must be continued for a long period and combined with galvanic electricity. Sodium iodid and ichthyol are used as internal adjuvants, but neither the medicinal nor the bath treatment alone will afford any results worth mentioning.

Neuralgic.—There are, above all, two forms of neuralgia which cause patients to complain of headache—the supraorbital and the occipital. Frequently the same causes lead to neuralgia and to true cephalalgia, and therefore one will often find both forms of pain together, and will have to decide if it is the neuralgia or the headache which governs the picture. Thus severe cerebral conditions may be complicated by neuralgia. For instance, a supraorbital neuralgia is not infrequent in thrombophlebitis of the cavernous sinus since the first branch of the trigeminal nerve passes through the lateral wall of the cavernous sinus. The paroxysmal occurrence and exacerbation of the pain, the presence of a tender point and a hyperesthetic zone corresponding strictly to the ramifications of the nerve, together with

the unilateral localization of the pain with no other manifestations of migraine, will all point to the diagnosis of neuralgia. The prognosis and treatment will depend on the primary condition.

Periosteal.—Periosteal affections of the cranium are rarely felt as headache by the patient who recognizes the strongly localized character of the pain. In rare cases, however, a traumatic or gummatous periostitis may be considered merely as a cause of headache. Careful examination of the skull, with regard to sensitiveness to percussion, will protect against such errors. A syphilitic periostitis need by no means always belong to the tertiary period. The first exanthem may be associated with periostitis, or the latter may even be found a few days before the first eruption.

Migraine.—Migraine is a very common disease, whose most marked symptom is headache. However, the condition is diagnosed oftener than it really occurs, if one does not limit oneself to the strict description of the disease. The typical attack cannot be mistaken. Almost always the onset of the disease reaches back to early youth. In the family, migraine or some other neurosis or degenerative psychosis has occurred. The seizure begins suddenly, usually in the morning on awakening, and increases rapidly to an intolerable degree of painfulness, and after a few hours gives way again to entire well-being. The pain usually is strictly unilateral, and all sense impressions are felt as disagreeable and even painful. Nausea and vomiting are almost constant symptoms, and sometimes diarrhea. In severe cases a state of hemicrania may develop, which lasts for several days and nights; in light cases a free interval of months may follow an attack of several hours, and all grades of transition between these two forms exist. The findings during the attack are varied; the face is sometimes pale, in other cases intensely flushed, which leads to the supposition of two different types of migraine. The pupils are usually contracted in contrast to their action in other painful affections. Inequalities in the pupils may be observed.

Theory.—Eulenburg has divided hemicrania into two groups, according to the sympathetic symptoms above described:

1. Hemicrania sympatheticotonica sive spastica, with paleness of the face, dilatation of the pupils, contraction of the temporal artery, and an exacerbation on compression of the carotid artery.

2. Hemicrania sympatheticoparalytica, with redness of the face, injection of the conjunctiva, lacrimation, contraction of the pupils, and of the palpebral fissure, and improvement on compression of the carotid artery.

However, the vasomotor and pupillary changes, mostly bilateral, by no means always correspond to the vasomotor manifestations. Symptoms which point to vascular spasm may be associated with

myosis. Unilateral secretion from the nasal mucous membranes is sometimes seen.

We see, therefore, that the clinical manifestations fit into Eulenburg's classification only in a small number of cases, giving his table only an historical interest. In recent times, A. Spitzer has tried to give a mechanical explanation for the attack of migraine. He believes that the disposition to hemicrania consists in a stenosis of the foramen of Monro which may be completely obturated if the lateral choroidal plexus becomes swollen. Stasis of the ventricular fluid, dilatation of the ventricles, and pressure of the cerebral hemisphere are the results. If there are subarachnoidal adhesions, they may be stretched on the dilatation of the ventricles, and the cerebral cortex may become unfolded, thus producing the sensory manifestations known as aura. The pressure toward the dura leads to headache, which is felt on the opposite side; the aura and headache reach the consciousness contralaterally to each other.

Differential Diagnosis.—It is important to distinguish migraine from similar attacks occurring sometimes in brain tumors, in which the unilateral appearance of pain and vomiting is quite frequent. But whereas the patient with hemicrania feels entirely well in the intervals free from attacks, the subject of brain tumor is never quite normal, either in his somatic or his mental condition.

Against the headache of tumor we are entirely helpless except for the radical operation, whereas rest and the absence of any kind of irritation usually give relief in any kind of migraine. The sensitiveness of the cranium to percussion is a weighty symptom for the diagnosis of tumor. Especially the ophthalmoplegic migraine, which, commencing as a typical attack, leads to a unilateral oculomotor paralysis, is readily distinguished from severe brain affections by the progressive course of the latter.

In migraine, appearing at an advanced age, incipient tabes must always be suspected before the diagnosis is made. Neuralgia of the first branch of the trigeminal nerve may simulate an attack of migraine, as unilateral headache, and vasomotor and secretory manifestations are also present here. However, the free intervals and the attack itself are usually shorter in neuralgia. The presence of points of pressure speaks for neuralgia, vomiting for migraine.

Prognosis.—Migraine is a condition usually persisting throughout life and disappearing only at advanced age. Many clinicians believe that the attacks, especially when frequent, lead in time to degeneration of the cerebral vessels, to apoplexy, and softening of the brain. Mono- and hemiplegia, aphasia, hemianopsia, and epilepsy are believed to be not infrequently the final termination. Yet it is doubtful if a causal connection really exists. Whether migraine bears

any relation to glaucoma is not yet decided, though the possibility must be conceded. An attack of pain on incipient glaucoma is at first often taken for hemicrania. If the patient complains of seeing all the colors of the rainbow around lights, this must not too hastily be diagnosed visual aura, but the intraocular pressure of the eye must be examined. Among other disturbances of the eye, defects in the visual field with scotoma have been observed after migraine. In rare cases not only anemia of the papilla, but thrombosis of the central artery of the retina and blindness develop after an attack.

Treatment.—The treatment endeavors to improve the hemicranic constitution, to remove all exciting factors, and to give relief in the attack.

A temperate mode of life, fresh air, avoidance of mental and physical overexertion and of psychical irritation, as far as possible, will mitigate the condition greatly if these measures are carried out methodically for years. Arsenic and iron are of good service. Constipation must be relieved. Nasal, eye, and gynecological affections must be removed by appropriate treatment. Since migraine may result from anomalies in refraction, accommodation, or from changes in the eye muscles, the correction of these conditions will improve the hemicrania. Snell pointed out that it is often dependent on even a very slight degree of astigmatism (0.75 D).

If migraine becomes exacerbated during the climacteric it is advisable to give laxatives and to exclude meat from the diet.

During an attack absolute rest and the suppression of all irritation is essential. The room should be darkened and no word should be spoken. Some patients feel relieved by cold compresses, others by a thermophore on the neck or by a hot foot-bath.

Of the medicinal remedies, Charcot recommended sodium bromid in daily doses of 3 to 6 gm. for several weeks, but the drug should be administered with care, and only increased when absolutely necessary. Fowler's solution with sodium bromid is sometimes beneficial. Of other drugs, the antipyretics, as sodium salicylate, antipyrin, antifebrin, phenacetin, pyramidon, and cephaldol, etc., are used. Each patient usually has his own remedy, which is more serviceable to him than any other. It is advisable to change the drug frequently, as the patient may soon become accustomed to its use.

The various theoretical conceptions regarding the pathogenesis of migraine were reflected for a time in the treatment. Nitroglycerin and sodium nitrate were prescribed in the angiospastic form, ergotin in the paralytic, however, without great effect. L. Edinger prefers caffein in the following mixture:

Rp. Antipyrin, .5
Past. Guaran., .3
Caffein. citric, .02
Mf. pulvis. Dt. dos No. X.
DS. One or two powders at intervals of one hour.

Caffein citrate of antipyrin, known as migrainin, is valuable in some cases. L. Edinger believes that many attacks may be prevented or at least arrested at onset if food is taken in small quantities at short intervals (about two hours) and if something is eaten in the morning before leaving the horizontal position of the bed. Galvanization of the sympathetic nerve may be tried. In angiospasm the anode should be applied to the cervical sympathetic; in angioparalysis, the cathode. Erb found that the transverse and longitudinal conduction of the current through the head, and galvanization of the sympathetic without regard to the different poles were of good effect; provided, however, that the treatment was continued for several months. Galvanization must be performed with great care, as strong currents may lead to disagreeable accidents. During the attack itself not much is to be hoped for from the electric current. School children may suffer from migraine; they should be relieved from mental work, and during an attack kept in a quiet dark room; migrainin, in doses of 3 to 5 gm., should be administered.

Symptomatic Migraine.—It has been previously emphasized that attacks of hemicrania are not infrequently observed in the course of tabes, progressive paralysis, and brain tumor. In juvenile tabes and paralysis, especially due to hereditary syphilis, this symptomatic migraine is found more frequently than in adults; whereas otherwise headache is not an essential symptom of hereditary lues unless it is its only one.

In adults migraine may develop at the same time as tabes, or even previously. If a person has suffered from migraine from early youth and then acquires tabes, the attacks of hemicrania may recede, as they may after another intercurrent disease. In the first stage of brain tumor typical attacks of migraine are not infrequent. Only gradually the headache becomes persistent. Similar attacks may be brought about in children by tubercles in the brain. The relations between epilepsy and migraine are very intimate, so that Féré considers both diseases as a nosologic entity. However, no symptoms of motor irritation are present in migraine. Moebius declares that if the case of migraine during the attack shows a slight retraction of the angle of the mouth or of the tongue, it must be considered as a larvate epilepsy. If the true seizure fails or ceases with the aura, only the observation of further attacks or a careful history of the previous course will explain the condition. The attacks of headache in syphilis,

malaria, and nephritis, etc., do not belong really to symptomatic migraine. Though apparently the picture of migraine is present, the diagnosis has to be given up if the headache is recognized as the nocturnal seizure of syphilitic cephalalgia, as malarial neuralgia, or as a beginning uremia. The treatment is the same as in idiopathic migraine, but the primary disease must also be considered.

Organic Affections of the Brain.—Dura Mater.—As the dura mater is the seat of headaches, a diseased condition of this membrane will lead us to expect this symptom. Thus old people, especially those suffering from internal hemorrhagic pachymeningitis, during the periodical relapses complain of violent pressure in the head. On postmortem examination of persons who have suffered from headache for years, one finds very often firm adhesions between the dura mater and the bones of the skull (trauma? syphilis?), and very large Pacchionian bodies, pointing to old inflammatory and circulatory disorders.

Sinus Phlebitis.—That sinus phlebitis should be associated with violent headache is readily understood. If, in the course of a purulent otitis, the putrefaction decreases, and chills, vomiting, fever, and violent headache set in, one should always think of a sinus thrombosis of septic character. The pain is usually diffuse, but sometimes localized on the forehead and sometimes on the occiput; it is rarely unilateral.

Leptomeningitis.—In acute as well as chronic leptomeningitis, headache is an essential symptom. The pia as well as the arachnoid is very poor in nerves as compared with the dura, and therefore the violent headache, even during somnolence, must be ascribed to cerebral pressure or to circulatory disturbances in the dura.

Syphilis of the Brain.—The headache of syphilitic meningitis is characterized by its exacerbation during the night, and especially toward morning. Syphilitic endarteritis and periostitis may sometimes be the inciting factor. This basal cephalalgia, often exceedingly violent, is localized by the patient deep in the head, and is associated with tenderness on percussion in the temporal region. These forms of syphilitic headache usually appear within the first three years after the infection and have no connection with that at the time of the eruption of the first roseola, which is of a toxic infectious nature. In the first few days a morphin injection will be necessary in order to give the patient a night's rest. An energetic iodid and inunction cure, introduced at once, even if the diagnosis of syphilis is not absolutely certain, may give rapid relief, and often a miraculous improvement of all other nervous symptoms, while any delay may be followed by fatal consequences.

Tumor of the Brain.—The treatment of nonsyphilitic brain

tumor must be surgical, which in some cases (50 per cent.) gives very good results. An early diagnosis is essential. The headache may hint at the presence of the affection, and gives, if judged cautiously, a certain aid to topographical diagnosis, which of course is only of value in connection with the other symptoms.

In the Frontal Region and Posterior Cranial Fossa.—Tumor in the frontal lobes causes headache, even at the onset, in 34 per cent. of cases, while it is a symptom never absent in the later course of the disease. If the tumor extends deep into the medullary substance, the patient may complain of headache in the temporal region. It is usually localized in the frontal region, however, and in many cases even on the affected side. Still the statements of the patient may be fallacious. They may be most relied upon if the pain sits in the occiput or even in the neck and radiates into the arms and shoulder-blades; in this case we very often have to deal with a tumor in the posterior cranial fossa, but even here the patient may complain of pronounced frontal headache.

Localization of Brain Tumors.—The pain in brain tumor often changes its seat on repeated examination. If, however, the patient complains constantly of pain in a circumscribed area, the tumor may be suspected at this point, or nearby, with some probability. Paroxysmal exacerbations from congestion of the brain (alcohol, etc.), and alterations in the intensity of pain on changes in position are sometimes mentioned by the patient. If the pain is of a pulsating character, the rare possibility of aneurysm must be thought of.

Treatment of Tumor Headache.—The tormenting headache of tumor is only little relieved by narcotics, and then only for a short time. Trephining will sometimes have excellent palliative results, even if the radical extirpation of the tumor is not feasible. Lumbar puncture, so beneficial in other forms of increased intracranial pressure, is in brain tumor, especially in that of the posterior cranial fossa, useless, and occasionally even injurious (obturation of foramen magnum).

Abscess of the Brain.—Headache in abscess of the brain is so violent, in the first stage of the disease, while no somnolence exists, that it disturbs the night's rest. It may be diffuse or more intense on the affected side, and sometimes, especially in abscesses of traumatic and otitic origin, it points rather accurately to the diseased area. The treatment should be surgical if possible; otherwise, antiphlogistic. Antineuralgics and morphin must be used to relieve the pain.

Hydrocephalus.—Under the term hydrocephalus we comprise quite different diseases which have in common only the effusion of a watery liquid between the surface of the brain and the osseus capsule of the skull or into the ventricles. Acute hydrocephalus, a symptom of meningitis, is associated with violent headache and with

other symptoms of brain pressure. The same is true of meningitis serosa, whereas in chronic hydrocephalus headache is sometimes entirely absent.

The external chronic hydrocephalus occurring in many cases, with a decreased volume of brain, as hydrops *ex vacuo*, presents a very complicated cerebral disease, owing to the primary affection of the brain, but scarcely causes severe headache. The internal chronic hydrocephalus, on the other hand, whether of luetic nature or due to other etiological factors, as alcoholism of the father, causes, beside other symptoms of cerebral pressure, headache, not only at an advanced age, but probably even in infancy, as may be suspected from the behavior of the little patients. Lumbar puncture, methodically repeated, is in these cases the only known treatment which may arrest the condition.

Congenital Hypertrophy of the Brain.—Congenital hypertrophy of the brain may or may not cause pressure symptoms. The characteristic symptoms usually appear only after the first few years of life, as previous to this time the skull is too elastic to permit the development of pressure symptoms.

Functional Disturbances.—Neurasthenia.—An exceedingly important rôle is played by headache in functional neuroses and in other functional disturbances. Most patients suffering from neurasthenia complain constantly of headache, deducing from this evil the gravest fears of threatening diseases, such as softening of the brain. On closer questioning, they concede it is really not a pain, but a pressure, which has a deleterious effect on their dispositions and on their faculty to work. They feel as if they had a hoop or a too narrow helmet on their head (casque neurasthenique of Charcot). The patients must first be calmed as to the seriousness of their condition. Their mode of diet should be regulated to frequent small meals; further, fresh air, sufficient sleep, and pauses in mental work must be provided. A sojourn in the country for several weeks is very effective in providing recreation from mental work. The use of a menthol pencil and of luke-warm, but never cold douches on the head, are felt as agreeable. School children may be affected with this form of cerebrasthenia, from mental overexertion or too long hours in badly ventilated school-rooms. In lighter cases it will be sufficient to ascertain that the children take a sufficient breakfast in the morning before going to school and that a few hours later they take a small lunch. In severe cases it will be necessary to remove children from school for a few weeks, if vacation is not at hand. Coexisting anemia and constipation must be combated and the question must be answered whether visual disturbances or adenoid vegetations do not simulate the picture of nervous school headache.

Hysteria.—A still more hopeful field for the therapy of headache is that of hysteria, provided we do not have to deal with a case of migraine, which of course may coexist with the hysteria. Whereas in neurasthenia the headache is very frequently localized on the forehead, hysterical persons usually complain of pressure on the top of the head, which may become so severe that they have the sensation of a nail driven into the head (clavus hystericus). Pressure points may be present in the sagittal suture and laterally from it on the parietal bones, and, indeed, such hyperesthesia of the scalp exists that combing the hair cannot be tolerated. Neuralgic pains in the region of the major occipital nerve and stiffness of the neck may be present, presenting a meningeal picture (pseudomeningitis hysterica). The treatment is entirely suggestive and accomplishes recovery in a short time—even after a long duration of the trouble.

Traumatic Neurosis and Congestive Hyperemia.—Headache, or rather pressure on the head, is a very common symptom in traumatic neurosis. It appears during work and robs the patient of all his joy and confidence in it. If a patient once becomes habituated to his hypochondriacal ideas, the prognosis of this condition is not favorable. Prophylactically, one may do much for a patient who has suffered from an accident by stimulating his pleasure in work and by suppressing every thought of a life-long income from the insurance company with a life of leisure. It cannot be denied that the nervous disorders of traumatic neurosis have some connection with vasomotor conditions. Such patients suffer from congestions and sometimes present such an overexcitability of their vasomotor nerves, that dermographism and factitious urticaria is produced. Cerebral congestion may, as we know, sometimes cause violent headache. The face is strongly flushed and somewhat blotched, the carotids pulsate violently, and an intense pain is felt in the temporal and especially in the parietal regions. At these points edematous swellings are sometimes found. At the same time there exists a general tendency to erythema fugax, and Eulenburg believes the whole condition to be a paralysis of the sympathetic nerve. Of course, headache is to be expected only when the dura is also involved in this affection of the vessels. In this way may be explained the disparallelism between the vasomotor insufficiency and the headache. Sometimes strong congestions in the head, as in the menopause, may cause no headache, whereas, on the other hand, an inhalation of amyl nitrate may produce it before a general vasomotor paresis has developed.

The prognosis is generally favorable, if one excludes old traumatic neuroses and those cases where the vasomotor headache is merely a symptom of a much more severe latent affection. The treatment must aim to relieve the congestion in the head, the best way being

by derivation to the intestines. This raises the question if another explanation is not the right one, namely, the removal of an auto-intoxication due to intestinal atony. Laxatives combined with anti-fermentatives give, in fact, excellent results. The congestion is certainly relieved by foot-baths or the Scotch or the fan douche applied to the feet. Slight faradization of the head and a general tonic treatment, a sojourn in the mountains, strychnin, and arsenic give good results, whereas sea air seems to act unfavorably.

Antipyretics act only for a short time, and the action of ergot, theoretically so suggestive, has not fulfilled expectations. The trouble usually disappears of itself at more advanced age.

Headache following Concussion of the Brain.—In the headache following trauma on the head, which often persists for a long period, we have to deal with a circulatory disturbance, which, according to the severity of the concussion, requires a varying length of time for reparation. This will be longest in arteriosclerotic changes of the cerebral vessels. The most important point in the after-treatment of concussion is a sufficiently long rest in bed. Occasionally a marked exacerbation results from too early getting up.

Headache of Puberty.—To cerebral hyperemia must be ascribed also the headache of boys and girls which appears about the time of puberty. Other symptoms, as a rush of blood to the head, vertigo, swimming of objects before the eyes, and tinnitus may coexist. The discomfort is increased if the venous outflow from the head is hindered, as by wearing too tight clothing, especially collars. Dyspeptic disorders, constipation, and the abuse of alcohol and nicotin, especially injurious at this age, play a part as inciting factors.

Menses and Menopause.—The congestive headache at the time of the climacteric must be combated as in the other forms of vasomotor cephalalgia. Ovarian tablets may be given, beside, to relieve the special disorders The normal and pathologic menstruation, its absence in pregnancy or from other causes, and even the nonappearance of periodical hemorrhoidal hemorrhage or of habitual epistaxis may incite vasomotor headache.

Headache following Exertion, Emotions, Insolation.—Here belong the most common forms of transient headache by which healthy individuals are attacked after mental and physical exertion, psychical emotions, influence of great heat, and insolation. There are all grades of transition, from the harmless headache which appears from marching in the heat of the day to the fatal forms of heat congestion.

Toxicosis and Autointoxication.—Acute as well as chronic intoxications are in the majority of cases associated with headache, unless a severe injury of the central nervous system has given rise to a

somnolent condition. As, fortunately, we are often in the position to treat the toxicosis etiologically, this will always be the first indication. C. Binz warns against the local application of cold in the form of the cold compress in these cases. By inspection of the face, palpation of the carotids, auscultation of the heart, and by the examination of the warmth of the skin we must form an opinion whether it is a case of congestion or of anemia. Especially in collapse temperatures, the deprivation of heat would be dangerous. Preferably the head should be lowered, the entire body kept warm, and the thermophore applied to the neck. In chronic intoxications severe cerebral changes may develop, in which headache plays an essential part, as, for instance, in encephalopathia saturnina. In the pathogenesis of severe, habitual headache, as well as of pressure on the head, so frequent in neurasthenia, beside uremia, intestinal autointoxication is of great importance. There is no doubt that many cases of acquired neurasthenia in persons of previously vigorous nervous constitution may be traced back to intestinal atony and autointoxication. There seems to be a certain relation between neurasthenia and the insufficient exercise which leads to intestinal atony; the undoubted success in many of these cases of a treatment directed against intestinal atony and autointoxication speaks for this connection. A laxative is sometimes sufficient to improve the condition for a few days and to remove the headache temporarily. The opponents of this conception may consider this merely as a derivation to the intestines. This view must be abandoned, however, if we succeed in healing this chronic condition by relieving the constipation and by the persistent use of antifermentatives and an antiputrid diet (A. Pick). Since neuralgia may occur in various intoxications, on hearing complaints of headache we must take into consideration this possibility.

Infection.—Headache is an almost constant symptom in acute infectious diseases. Nothing is yet known of the chemical nature of those substances which cause the fever and headache. Therefore we do not know whether in the various infections we have to deal with the same or different chemical noxæ and whether we have to regard the infectious headache as an etiologically uniform symptom or not. Undoubtedly the headache in the different infectious diseases is of varied character. If we exclude those morbid conditions which, from their intracranial localization occupy a peculiar position (empyema of the frontal sinuses and neuralgia), there still remain great differences in the headaches of the various infectious diseases. There is no parallelism between the height of the fever and the intensity of the pain, which only to a certain extent is explained by the fact that at high temperatures the affected consciousness hinders the perception of pain.

The febrile turgescence of the face, the increase of the headache by all factors favoring congestion, the relief afforded by the application of cold or the withdrawal of blood, permit us to see the immediate cause of the infectious febrile headache in hyperemia of the dura mater. This does not mean that the headache is purely of vasoparalytic origin; a direct action of the toxins on the nerve ends in the dura is by no means excluded.

Typhoid Fever.—At the onset of typhoid fever, violent headache is always present in the frontal region or at the occiput; sometimes patients complain of the sensation of a hoop constricting the head. Neuralgia of the trigeminal and occipital nerves may be present at the same time, scarcely ever unilateral cephalalgia, even in patients subject to migraine. At the beginning of the second week the headache usually decreases, though the fever has reached its acme and the sensorium is entirely clear. If this improvement of the headache fails, and the pain rather increases and is perceived by the patient even in the somnolent state, so that he moans aloud and holds his head with his hand, one must think of a possible complication on the part of the brain. Meningitis, apoplexy, embolism, thrombosis, encephalomalacia, brain abscess, and sinus phlebitis will be possible complications.

Exanthematic Typhoid.—Before and during the eruptive stage of exanthematic typhoid, frontal headache is usually present, often radiating from the occiput toward the neck and shoulder region. At the height of the disease the central nervous system is usually affected to such a degree that sopor or even violent delirium develops, annihilating the perception of headache.

Recurrent Fever.—In recurrent fever, the headache usually follows the fever curve exactly, lasting throughout the fever, but being absent in the afebrile interval. It is apt to be a frontal headache and is greatly relieved by nose-bleeding. Neuralgic and hemicrania-like attacks occur, especially before the critical fall of temperature.

Malaria, Herpes Febrilis.—The short febrile attacks of malaria and of herpes febrilis are associated with headache at the rise of temperature. In malaria it is very violent and a constant accompaniment of the attack. Supra- and infraorbital neuralgia of the trigeminal nerve must always be thought of in malaria. It may cause regularly intermittent attacks in a larvate malaria.

Erysipelas.—Erysipelas is always associated with headache. The presence of this symptom when the disease is not localized on the head proves that the headache is not due merely to mechanical disturbances of the circulation in the dura. If headache becomes very violent, we must always think of possible complications, as menin-

gitis, and if the erysipelas has originated from nose or pharynx, of suppuration in the accessory sinuses, especially of empyema of the frontal sinus.

Influenza.—These sinus empyemas are very common in influenza. They often cause tormenting neuralgia of the supraorbital nerve. Neuralgia may be caused by the effect of the bacterial toxins alone, without such a complication, as is proved by the existence of occipital neuralgia. This may continue for a long time in the period of convalescence, and even incurable neuralgia or such lasting for years may be traced back to influenza infections. Violent headaches are sometimes present in influenza, becoming the most harrowing symptom of the disease, and leading to paroxysms of intense pain in which the patient presents the picture of cephalæa agitata or cephalæa attonita. The pain may affect the whole head or be confined to the forehead, the orbits, temporal region, or occiput. In some cases the condition resembles meningitis.

Measles.—The condition is similar in measles, where not only the toxic action and the development of the unknown agent, but also those of the secondary microorganisms, as influenza bacillus, diplococcus, may produce headache and neuralgia from suppurative processes in the accessory sinuses.

Scarlet Fever.—At the onset of scarlet fever headache is a constant manifestation of the infection. In the further course of the disease headache will point to the presence of complication, as empyema of the nasal sinuses, otitis, and even meningitis and encephalitis. It is in the scarlatinal nephritis that the appearance of headache deserves most attention, as it may announce a beginning uremia. In the postscarlatinal lymphadenitis, on the other hand, which is not rare in the third or fourth week of the disease, the general sensation of well-being is in striking contrast to the high fever. It is this behavior which will lead to the diagnosis of this harmless sequela, whereas the other sequelæ are usually associated with severe headache. There exists a certain undersensitiveness of the nervous system to the toxins, which may develop on the prolonged persistence of an infection; this same behavior is noticed in the second week of typhoid fever.

Small-pox.—The temperature curve in small-pox shows two rises, that of the proruption and that of the suppuration fever, separated by an afebrile interval. The headache follows the same course. The cephalalgia decreases sometimes considerably during the prodromal stage, before the exanthem has developed, at any rate during the height of its development, and increases anew in the stage of suppuration. A persistent violence of the headache will here also point to complications.

Epidemic Parotitis.—An otherwise harmless parotitis may sometimes lead to intolerable headache.

Acute Articular Rheumatism.—In the greater number of cases of acute articular rheumatism headache is not a usual complaint; there are cases, however, in which this is the case, the cephalalgia rheumatica congestiva, or the cerebral rheumatism. The latter condition may simulate an anatomical meningitis, until the rapid recovery proves the functional character of the disorder. The prognosis of cerebral rheumatism is said to be better in children than in adults, but it may lead to chorea minor. Severe headache with other nervous manifestations, as restlessness, and hyperesthesia of the skin are serious symptoms in acute articular rheumatism.

Bronchitis.—Acute bronchitis in the beginning leads to violent headache, probably of infectious toxic origin, whereas in chronic bronchitis it is probably due rather to congestion. In children suffering from capillary bronchitis very intense neuralgia-like headaches are sometimes observed.

Acute Miliary Tuberculosis.—In acute general miliary tuberculosis the patients commonly suffer from headache. It may be purely toxic or the expression of the dissemination of miliary tubercles in the meninges. In the symptom-complex following the injection of tuberculin headache often occupies the chief place.

Chronic Pulmonary Tuberculosis.—In the chronic course of phthisis headache is not very frequent; highly febrile patients often feel entirely well. However, this almost proverbial euphoria may be absent, and the consumptive patient may suffer from cephalalgia without cerebral complications of an anatomical nature. Its cause is sometimes certainly cerebral anemia, and then it will respond remarkably to the rest cure and a horizontal position. Neuralgia of the occipital nerve is not infrequently considered as headache by the patient. Persistent headache of a severe character points, in most cases, to a tubercular involvement of the meninges.

Syphilis.—Syphilis, in its first manifestation as a general infection, in the roseolar stage, frequently leads to cephalalgia. There is then a certain resemblance to measles, but the absence of the symptoms of the mucous membranes and the slight extension of the exanthem to face and extremities will protect against erroneous diagnosis. The treatment will consist in an inunction cure. In grave cases, lumbar puncture renders great relief in the headache. In the further course of syphilis, not merely in its late forms, involvement of the central nervous system is frequent. All those causative factors playing a part in the pathogenesis of nonspecific nervous diseases will here have to be considered, as hereditary tendency, chronic intoxication with alcohol and lead, trauma, and overexertion of the brain by mental

and physical work. There are cases of syphilis præcox of the nervous system which develop within the first year, and even in the first months of the disease. The diffuse syphilitic infiltrations of the meninges, the formation of gummata in the cerebral membranes and cortex, as well as the specific endarteritis and endophlebitis, with their deleterious influence on the circulation, are the changes most frequently found. In all these various conditions, as well as in the periosteal and osteal affections of the cranium, headache occupies an important position. An energetic treatment with mercury and iodin instituted at once promises in many cases not only preservation of life, but also considerable improvement of the paralytic manifestations. Also in post- and parasyphlitic diseases headache is frequent.

Progressive Paralysis and Tabes.—In the first stage of progressive paralysis, the neurasthenic stage, a distressing pressure on the head is present, which may be due to hyperemia of the meninges. There is a sensitiveness to pressure along the cranial sutures; attacks of migraine without an hereditary disposition are of symptomatic value for the diagnosis of an incipient progressive paralysis of tabes. In the advanced stage of the disease all these symptoms of irritation usually disappear until some complication, as internal hemorrhagic pachymeningitis, calls forth anew severe headache. Beside the symptomatic migraine of tabes dorsalis, which has been mentioned previously, neuralgia of the trigeminal and occipital nerves is frequently observed in cervical and cerebral tabes.

Treatment of Headache in Infection.—The chief antineuralgics may be briefly mentioned. Antipyrin, given in daily doses of 1 to 1.5 gm.; children receive as many centigrams at each dose as they are months old, or as many decigrams as they have years (in pertussis). Migrainin, the caffein citrate of antipyrin, is given in powders containing 1 gm. once or twice a day. It acts well not only in migraine, but in the headache of influenza, neurasthenin, and acute intoxications. Pyramidon, dimethylamidoantipyrin, given two or three times a day, in doses of 0.2 to 0.5 gm. Trigemin, a compound of pyramidon and chloral butylicum, has the same indication, dose 0.5 to 0.75 gm. one to three times a day. Lactophenin, in adults, in doses of 0.3 to 0.5 gm. every three hours. It is also well tolerated by children in doses of 0.1 gm.

One of the most effective drugs against the headache of acute infectious diseases is phenacetin, whose use requires some precaution, as there is a tendency to collapse with the fall of temperature, and the rise a few hours later is not rarely preceded by a chill. Before using this remedy one will have to consider the cardiac force. It is best combined with small doses of caffein, given in doses of 0.4 to 0.5 gm.

three times a day. Exalgin, methylacetanilid, may be given in doses of 0.25 gm., 1 to 4 powders being prescribed daily. A very appropriate preparation for children is acetopyrin, the acetylsalicylate of antipyrin. It is given in the following doses: From the sixth month to one year, 0.05 gm. *pro dosi*, to 0.2 gm. *pro die*. From the first year to the second year, 0.2 gm. *pro dosi*, to 0.4 gm. *pro die*. From the second to the fifth years, 0.4 gm. *pro dosi*, to 0.8 *pro die*. In adults one may give 0.5 to 1 gm. *pro dosi* and even 4 gm. *pro die*.

Constitutional Diseases.—Plethora Vera.—Complaints of headache are very frequently heard in constitutional diseases of various kinds. Plethora vera probably causes a congestive headache, at least a sense of pressure in the head, and patients ask for venæ puncture repeatedly, against the advise of the physician.

Anemia.—All anemic and chlorotic conditions lead to headache, which increases especially if the patient stands a great deal and on physical or mental exertion, but improves rapidly on rest in bed, with the trunk horizontal and the head low. Rest and overfeeding and the administration of iron and arsenic will soon improve the headache. The anemic headache in chlorosis is best explained as an anemia of the meninges due to their insufficient supply of oxyhemoglobin.

Nephritis; Uremia.—Headache, dizziness, and hemicrania are often premonitory symptoms of an acute uremia; also in chronic uremia headache is one of the most obstinate symptoms. This is one of the many reasons why the urine should be examined in every patient. The treatment of this headache coincides of course with the measures employed for the threatening uremia. Lumbar puncture has given relief in some cases.

Whether the poisons of the uremic autointoxication produce the cephalalgia by their direct action on the dura or indirectly by influencing the circulation is a question still undecided. The rise of blood pressure in chronic interstitial nephritis may incite cephalalgia by purely mechanical means without any uremic component. As the precursor of a threatening cerebral hemorrhage it will demand anticongestive measures, as rest in bed, avoidance of all exertion and excitement, cold applications, laxatives, and venesection.

At the onset of an acute nephritis with fever, the headache is by no means always of uremic nature, but may depend, as a coordinate symptom, on a common cause with the nephritis.

Diabetes Mellitus.—Diabetics frequently suffer from headache, in the first place, because many are of a neurasthenic constitution. In some cases it is a premonitory symptom of the diabetic coma. Naunyn relates that a number of his patients come to him complaining only of headache. Beneath the complaint of headache is certainly often the diabetic neuralgia. There exists no connection between the

intensity of the headache and the quantity of sugar excreted, and no relation with the severity of the case in general. Typical migraine and purulent meningitis have been observed.

Diabetes Insipidus.—The primary condition of diabetes insipidus is not infrequently a severe cerebral process and the presence of cephalalgia will not be surprising. It is not an essential symptom of the disease unless there is some affection in the brain, as tumor, hydrocephalus, meningitis, etc.

Acromegaly.—Acromegaly, which cannot be considered as a purely constitutional disease, as symptoms of brain pressure are produced by the tumor of the hypophysis, is accompanied by very violent headaches, usually exacerbating at night, sometimes by migraine-like attacks and pronounced symptoms of brain pressure. The treatment of this headache consists first in the administration of sodium iodid, which acts on the hypophysis as well as on the thyroid. Thus Kovacs reports a case in which sodium iodid brought considerable improvement, especially in regard to the pressure symptoms. The common antineuralgics help in this form of headache, too, but usually only in excessive doses, so that symptoms of anilin poisoning may develop.

Uric Acid Diathesis.—Patients with uric acid diathesis complain very frequently of headache. In these cases there are no specific gouty deposits in the meninges; rather the cephalalgia is due to a neurasthenia which has developed on the ground of the gouty disposition. However, the headache improves considerably if we succeed in improving the gout by dietetic measures.

Graves' Disease.—Headache does not play a great part in Graves' disease and may be absent in the severest cases. Since these patients have constantly an irritated nervous system, they may, however, suffer from headache of a throbbing character, correlated with the throbbing of the carotids.

Affections of the Nose, Eyes, Ears, and Teeth.—Very frequently the causes of headache are affections of the nose; not only empyema of the accessory sinuses, but all the processes which hinder nasal respiration, as the adenoid vegetations in childhood and, in later life, hypertrophy of the mucosa of the turbinate bones, polyps, and neoplasms. Of eye affections leading to this symptom, hypermetropia must be mentioned first, as it causes headache in children in the school age. It demands an examination of the refraction in every case. Caries of the teeth, especially of the upper row, may produce violent cephalalgia, localized in the temporal region; the same is true of affections of the middle ear.

Traumatic.—Headache following trauma may appear very late, even after twenty days. For a secondary hemorrhage may develop

at the center of contusion rather late, leading to violent headache, and sooner or later to apoplexy.

Reflex.—By the severe irritation of sensory nerves in other, often very distant, regions, headache may develop, probably due to the action of the vasomotor nerves.

Idiopathic.—Even after the most careful examination we may not be able to enlighten ourselves as to the nature of a headache. The term idiopathic, applied to this headache, concedes the incapacity of our diagnostic knowledge.

CHAPTER XXI

LOSS OF CONSCIOUSNESS

(Including Intoxications)

VARIETIES

General Remarks.—A very frequent symptom, demanding a quick diagnosis and prompt action, is loss of consciousness. The position of the physician in such cases is a very difficult one, as the patient himself is unable to furnish any data as to the previous history, so important for the diagnosis, or to make any statements concerning his subjective sensations, sensibility to pressure, etc. Often there is imminent danger in delay and no time for a thorough clinical examination.

The conditions leading to unconsciousness are various. Apart from the disorders of consciousness which occur in diseases of severe nature, whose diagnosis is generally easy, there are those occurring in persons who up to that time had been well, or at least were supposed to be. This apparently primary form of unconsciousness will be considered first.

Though an attack of syncope sometimes results from sudden cardiac weakness, exhaustion, or psychical emotion, in other cases there are organic changes which account for it. In the former condition the patient soon recovers, but in the latter the loss of consciousness may be of serious danger to life. Depending on the age of the patient, the symptoms preceding the unconsciousness, and the momentarily perceivable clinical symptoms, we will think of affections of the brain, internal hemorrhage, comatose conditions, intoxication, drunkenness, or heat stroke.

Of cerebral affections, hemorrhage from the cerebral vessels and their obstruction have first to be mentioned. Paralysis, especially that occurring on one side of the body, may infrequently be recognized even during the unconscious stage and will aid in the diagnosis. Other important points are the rigidity of the arteries, the evidence of a cardiac or renal affection or of an old syphilitic infection. If the skin and mucous membranes are very pale and cool and the pulse small, filiform, and very frequent, we should think of internal hemorrhage. In distinction to other affections the pallor here continues even after the consciousness has been regained, and the attack

of syncope may be repeated as soon as the patient rises from the horizontal position. In coma in the course of a profound anemia, of diabetes, or of cancer, the odor of the exhaled air allows us to detect the presence of albumin, sugar, acetone, or acetoacetic acid, and points to the diagnosis. Intoxications may be followed by symptoms of unconsciousness; this diagnosis will seem plausible if the symptoms arose soon after the use of suspicious foods or drink, especially if the same or similar symptoms manifest themselves in several persons in the immediate neighborhood or in domestic animals. The condition of the skin, the oral mucous membranes, the odor of the expired air and of the vomited material, the reaction of the pupils, and the character and odor of the urine drawn off by catheter will furnish points of great weight.

Hemorrhage of the Brain.—*Causes.*—The symptom-complex in hemorrhage of the brain consists in loss of consciousness and in the manifestations of irritation or destruction of certain parts of the brain. Almost the only cause of spontaneous cerebral hemorrhage is the rupture of miliary aneurysms, whose occurrence is due to a degeneration of the muscularis without necessitating the presence of an endarteritis. The apoplectic habitus, hereditary disposition, chronic intoxication by lead or alcohol, syphilis, gout, atheroma, chronic nephritis, and cardiac hypertrophy are the factors predisposing to hemorrhage. It is more common in males than in females, and occurs usually after forty years of age, though sometimes at an earlier period. If young persons are stricken with cerebral hemorrhage, one will think of syphilis or chronic nephritis. Very rarely cerebral hemorrhage is found in children, and then chiefly in the course of whooping-cough. Butter first called attention to this fact, and A. Baginsky describes these severe seizures, sometimes followed by hemiplegia.

Symptomatology.—Certain symptoms may precede the onset of an attack, as headache, dizziness, weakness of memory, swimming before the eyes, tinnitus aurium, vertigo, excitement, disturbed sleep, formication, sometimes twitchings and a heaviness in a limb, heavy tongue, nausea, vomiting, and congestion or pallor of the face. These are in part signs of cerebral hyperemia, in part of the beginning hemorrhage, if its onset is gradual and not violent. As a rule, however, the attack sets in rapidly; the loss of consciousness may follow a scream and the collapse of the patient. The respiration is difficult and stertorous, the cheek on the paralyzed side becomes inflated at each expiration; and the lips and cheeks are retracted on inspiration; the face is pale and cyanotic, the pulse slow and sometimes full, and the pupils do not react. The various paralyses by which the attack is followed may often be recognized at this stage by the distortion of

the face, the passive falling of the paralyzed extremity, and the absence of certain cutaneous reflexes on the affected side. The respiration is accelerated, superficial, and irregular. The temperature, subnormal at onset, rises considerably, sometimes reaching 40° C. or more. It may be a fever due to resorption or to the irritation of the heat centers in the medulla. Especially in drunkards the temperature may fall enormously, even below 35° C.

The severity and duration of an attack may be very different. In light cases it is like a rapidly passing faintness, while in others it may last hours or days. It is noteworthy that in some cases with small extravasation paralysis may exist without loss of consciousness; this is especially the case if the hemorrhage is some distance from the cortex, as in the mesencephalon, in the cerebellum, or in the pons. On the other hand, loss of consciousness occurs sometimes without paralysis if the extravasated blood has passed into the so-called silent regions.

The reflex excitability is entirely lost in severe cases, the pupils are immobile, consciousness is not regained, and death follows after hours or days, often owing to a secondary breaking through of the extravasated blood into the ventricles. The commonest sequel of cerebral hemorrhage is a unilateral paralysis produced by the destruction of the internal capsule, which leads to paresis of the muscles supplied by the lower portion of the facial nerve, of both upper and lower extremities and, if on the left side, to loss of speech. Conjugate deviation of the eyes appears, due to irritation, and sometimes due to paralysis of the antagonists; the head and eyes are usually turned toward the nonparalyzed side, the patient looking toward his "focus," as the expression is. The pupils do not behave the same; they are often unequal, the pupil on the side of the hemorrhage being mostly dilated. The tongue deviates toward the paralyzed side; there is sometimes a paralysis of the velum palati, which hangs far down on the affected side. The reflexes are extinct during the period of deep coma; the tendon reflexes are usually augmented on the paralyzed side, but the skin reflexes are diminished both during and after the attack. Especially the cremasteric and abdominal reflexes are absent on the affected side. Sensiblity is soon regained in the affected region, and only in severe cases does it remain diminished for all sensation. Mobility may also improve. Though the condition often improves steadily after an attack, after a few days an inflammatory reaction may set in, announced by fever, restlessness, sleeplessness, dizziness, heat, redness of the face, and delirium; sopor, pronounced contracture of the paralyzed members, twitchings, and retardation of the pulse may be observed. The persistence of these symptoms is a *signum mali ominis*. Lasting sequelæ of cerebral hemorrhage, aside from the paresis of the affected extremities, are failure of the

memory, and change of character, sometimes to a choleric or whining disposition or to one of entire apathy (dementia postapoplectica). Disturbances of speech usually last a long time, even until death. Arthropathies may develop in the paralyzed extremities. In every case there remains the threatening danger of a new attack, as the primary affection is beyond our reach.

Diagnosis.—The sudden loss of consciousness at advanced age, with the following paralysis, the rigidity of the arteries, hypertrophy of the left ventricle, and signs of a chronic Bright's disease will furnish valuable data for the diagnosis. In regard to the differential diagnosis, a number of diseases of the central nervous system will have to be considered. First, meningitis, which, if its previous course is unknown, may recall apoplexy on account of the symptoms of hemiplegia. However, the hyperesthesia of the skin and muscles, the stiff neck, frequent convulsions, ophthalmoplegia, and the presence of optic neuritis will in most cases enable us to diagnose meningitis.

More difficult, indeed sometimes impossible, is the differentiation of cortical apoplexy and pachymeningitis hemorrhagica interna, the more as both diseases occur in chronic alcoholism. One should also not forget the "symptomatic" apoplectic attacks in the course of progressive paralysis, multiple sclerosis, brain tumor, and brain abscess. The differential diagnosis between uremia and apoplexy, both frequently occurring in interstitial nephritis, may be very difficult. The examination of the urine does not help a great deal, as not even the diagnosis of interstitial nephritis may be made from the examination of the urine drawn off by catheter, for in an apoplectic attack the urine may contain albumin and be of low specific gravity, even if the kidneys are entirely normal. Vomiting and the early appearance of convulsions and increased tendon reflexes speak for uremia, and pronounced hemiplegic symptoms are very seldom observed. Embolism of the cerebral arteries may occur at any age in heart failure, in aneurysm or in pulmonary affections (abscess, gangrene, tuberculosis); further, in endocarditis and myocarditis, whereas cerebral hemorrhage is most common in atheroma and nephritis. The differential diagnosis will be taken up under Embolism.

Beside embolism and thrombosis, the following conditions may give rise to mistakes in the diagnosis of cerebral hemorrhage:

1. The common syncope (fainting fit).
2. The different forms of coma.
3. Internal hemorrhage.

The syncope differs in the short duration and in the fact that the tendon reflexes are preserved. In the fainting fit the pulse is small and irregular, symptoms of palsy are absent. In regard to comatose conditions, their appearance is not sudden, but they are preceded by

symptoms due to the primary disease and by general weakness, anxiety, restlessness, dizziness, headache, and sometimes dyspnea. The examination of the urine sometimes reveals important facts, as in diabetic coma; the fruity odor of the exhaled air in this condition is sometimes helpful for diagnosis. In internal hemorrhage, also in rupture of an aneurysm, the paleness of the skin, the rapid diminution of the size of the pulse, the decrease in its tension, and the absence of any focal symptoms will furnish sufficient evidence, yet here focal manifestations may occasionally be present.

Subjects of epilepsy sometimes have fits with loss of consciousness alone and no convulsions. The anamnesis, the finding of scars through biting the tongue, the loss of urine, stool, and spermatic fluid, and the absence of paretic symptoms may lead to the right diagnosis; but the reaction of the pupils and the presence of albumin in the urine after the fit are of no value in this regard.

Prognosis.—The prognosis of cerebral hemorrhage is, under all circumstances, a serious one, since its recurrence constantly threatens, because of the degeneration of the cerebral vessels and the existence of miliary aneurysms. In judging the gravity of a given case, a sudden fall of temperature and later a rapid rise over 40° C. during the first day, as well as a duration of unconsciousness of more than forty-eight hours, have to be considered prognostically unfavorable. On the other hand, the absence of conjugate deviation, a short period of unconsciousness, the absence of Cheyne-Stokes respiration, are favorable points, albeit a repetition of the hemorrhage, even in these cases, cannot be excluded.

Treatment.—The therapeutical measures are: absolute rest, elevated position of the head, cutaneous irritation, and the application of an ice-bag or cooling apparatus on the head and of a cupping-glass over the mastoid process on the side of the hemorrhage. In earlier days venesection was done in every case. At present many authors disapprove of its use. Monakow speaks entirely against bleeding, for in the apoplectic attack not only certain parts of the cerebral cortex are mechanically contused by the extravasation, but entire areas of some cerebral vessels are compressed by the extravasated blood and thus made anemic. The cerebrospinal fluid, from compression of the neighboring parts, is expressed and collected in the ventricles and subarachnoidal spaces, respectively, where it is resorbed, if no obstacle against its resorption is present. This anemia of the cerebral cortex, which anyway is to be dreaded, is best removed by a good supply of arterial blood. Monakow considers the increased blood pressure and the full slow pulse as the first attempt at compensating the circulatory disturbance in the brain, induced by reflex irritation of the vasomotor center in the medulla oblongata. By venesection, in his

opinion, just the contrary effect would be produced. Yet other authors emphasize bleeding, provided the patient is well-nourished, with a full pulse, and strong heart action. In patients in apparent collapse, with feeble heart action, irregular pulse, and beginning pulmonary edema, bleeding is contraindicated. In such cases camphor or ether injections have to be given, mustard poultices placed on the chest and calves, and the skin rubbed with wet towels.

If consciousness has been regained, absolute rest in bed, a non-stimulating liquid diet, and care for regulation of the bowels are indicated. On appearance of reactive symptoms, cupping-glasses have to be applied to the mastoid process and Leiter's cooling apparatus placed on the head. After the process of inflammation is over, one may, in flaccid paresis, begin with faradization and light massage of the affected members.

Embolism.—*Symptomatology.*—Destruction of parts of the brain may develop from hemorrhage, but also from suppression of the blood supply, thus producing necrobiosis of the tissue. The clinical symptoms of arterial embolism are very similar to those of hemorrhage. A sudden loss of consciousness and sudden paralysis, more seldom vertigo or an epileptiform fit with the following paresis, are the most significant manifestations. During the attack the face is pale. The pupils react normally. In embolism of the Sylvian artery we find the picture of cerebral hemiplegia, as in hemorrhage of the brain; in embolism of the left Sylvian artery aphasia will be present. Embolism is quite frequent in younger individuals suffering from endocarditis, myocarditis, valvular lesions, atheroma, or aneurysm. If the presence of emboii in other organs of the body can be demonstrated, the diagnosis becomes quite certain.

Primary Diseases Leading to Brain Embolism.—The primary diseases leading to cerebral embolism are marasmus, cachexia, mitral stenosis, endocarditis, myocarditis, and aneurysm of the big vessels, putrid bronchitis, bronchiectasis, pulmonary abscess, gangrene of the lung, diphtheria, and sepsis; all these may lead to obstruction of cerebral arteries from aseptic or infected blood coagula or agglomerated masses of microorganisms, and the malignant neoplasms, in the same way, may cause destruction by tumor particles.

Diagnosis.—The duration of the attack in embolism is generally short; distant effects on the centers in the posterior cranial fossa, as disturbances of respiration, are only seldom observed; the phenomena of irritation, as spasms or convulsions, are more pronounced, but the differential diagnosis could not be made from these symptoms alone. The redness and turgescence of the face, the throbbing of the carotids, and the bradycardia, as found in the apoplectic seizure, are absent in the attack of cerebral embolism. Of great importance is a good

anamnesis, as may be seen from the enumeration of the above-mentioned primary conditions, but still they may lead to error, as in a certain case where a hemorrhage developed in the course of an endocarditis; the rapidly appearing loss of consciousness pointed, however, to the right diagnosis. If emboli can be demonstrated in other organs, as in the fundus of the eye (arteria centralis), or in the lungs or kidneys, the diagnosis will of course be greatly supported.

Prognosis.—As in cerebral hemorrhage, the prognosis is here also extremely doubtful, since the *causa mortis* persists, rendering a repetition of the attack possible. A retrogression of the symptoms is, however, possible even after a prolonged attack. In regard to the course, we distinguish the benign and the malignant form of embolism. The latter is often due to an ulcerative endocarditis or to a cerebral metastasis of a septic or gangrenous focus in the body. In the latter case it produces no encephalomalacia in the usual sense of the word, but abscesses and meningitis.

Treatment.—The treatment of the fully developed attack is identical with that of cerebral hemorrhage. Sedatives, as morphin, chloral hydrate, antipyrin, are indicated against the symptoms of irritation. The prophylaxis coincides with the treatment of the cardiac affection. In acute endocarditis or in cardiac weakness due to chronic valvular or myocardial diseases absolute rest is urgently indicated.

Thrombosis of the Cerebral Arteries and Encephalomalacia.—*Occurrence.*—Thrombosis of the cerebral arteries may call forth an apoplectic attack. If inflammatory processes exist in the intima of the vessels, and if owing to the lowered cardiac activity the circulation is retarded, blood coagula may form, obstructing the vessels of the brain. Complete obliteration may develop from proliferation of the vessel walls in syphilitic endarteritis. After poisoning with carbon monoxid encephalomalacia is sometimes observed.

Symptomatology.—Since the coagula are gradually deposited, the clinical manifestations, as a rule, develop very slowly. Weakness, headache, and vertigo, sometimes a decrease in mental activity, announcing itself by slight psychical fatigue and a weakening memory, as well as a change in character, may precede the attack. Paresthesias may appear at different places in the body as premonitory symptoms, and sometimes a severe apoplectic attack follows several small premonitory seizures. The symptoms of irritation are only slight.

Prognosis.—Since the thrombosis is followed by a softening of the portion of the brain involved, and since the cause of the thrombosis cannot be removed, while constantly threatening a repetition of the attack, and since marasmus, decubitus, and pneumonia endanger life, the prognosis must be pronounced decidedly unfavorable.

Treatment.—The treatment of cerebral thrombosis is practically the same as in cerebral hemorrhage. Venesection must not be performed here; after the acute symptoms have passed, the causal affection should be treated; cardiac tonics must be used if the heart is irregular, sedatives in states of excitation, and, in the further course, sodium iodid, to stimulate resorption. A quiet mode of life, abstinence from alcohol and from mental and physical exertion, a very mild, cold-water treatment, consisting in cold sponging and quick rubs, will be indicated for the future.

Arterial Anemia (*Syncope*).—*Occurrence.*—The immediate cause of syncope is the acute arterial anemia of the brain. It may originate from severe loss of blood or cardiac weakness or from stimuli which affect the vasoconstrictors of the cerebral arteries, and in this way, from stimuli which act on the psychical life, such as fright, disgust, etc. Bleeding of the patient into his own vessels, as after the removal of a large mass from the abdomen or after rapid drainage of large quantities of liquid, may lead to syncope. After severe hemorrhages, the vasomotor center is stimulated by the blood impoverished in oxygen, the splanchnic nerve is irritated, and thus by contraction of the large vessels in the abdomen, there is an effort at compensation. Cardiac weakness due to various causes may produce an insufficient supply of blood to the brain. In all these cases this may lead to syncope; and loss of consciousness will occur the more readily the less normal is the composition of the blood, as in anemia and chlorosis.

Symptomatology.—Cerebral anemia leads to symptoms of irritation, darkening of the visual field, mydriasis, dizziness, nausea, headache, and agrypnia. Only later and in severe cases is the consciousness affected, and respiration and pulse become intermittent suddenly or gradually. Cerebral anemia does not lead, however, in all cases to disturbed consciousness. In children who after diphtheria die from paralysis of the heart, we see vomiting and diarrhea resulting from the insufficient supply of blood to the brain, but consciousness is usually retained until death. Whereas in lighter cases syncope passes rapidly, it may last for a long time in severe cases. Even after consciousness is regained, headache, prostration, and nausea persist for some time.

Fainting Spells in Different Diseases.—Fainting is observed as a transient symptom in all diseases. In the absence of any morbid condition, it is found in states of exhaustion, in a persisting fatigue of the cardiac muscle due to excessive physical exertion, mountain climbing, dancing, etc. Attacks of swooning occur most frequently in anemic or chlorotic girls or in persons whose cardiac muscle, without being really diseased, has lost its functional capacity; long standing on the feet is sufficient to produce it in some persons, but

the horizontal position with the head low will soon bring about the disappearance of the spell. Prophylactically, even after slight surgical operations, the patient should be placed flat on the back and constricting clothes removed to produce favorable circulatory conditions in the brain. He is asked to make deep inspirations, as this leads to a better circulation. After severe hemorrhage, as from the stomach, the same position of the patient is indicated. A special disposition to swooning spells occurs in fatty heart and in diseases of the pericardium, in pericardial adhesions, also in stenosis of the mitral valve, but not in insufficiency. An irregular distribution of the blood, disadvantageous to the brain, may bring about syncope. Thus it is not infrequent in persons in whom, owing to abdominal affections, large dilatations of the veins have there developed, so that a large part of the total blood accumulates in them, resulting in cerebral anemia. Similar conditions exist in those cases where, on evacuation of abundant stool, a veritable feeling of annihilation overcomes the patient, followed by fainting.

Attacks of syncope in acute infectious diseases and in all chronic wasting diseases are due to cardiac weakness; they occur with special readiness if the patient sits up suddenly, as in typhoid fever, pleurisy, and pericarditis, and may be immediately followed by death. In affections of the brain, tumor, chronic meningitis, hydrocephalus, etc., affections in which the cranial space, normally at the disposition of the blood, is, so to say, diminished, and where the blood supply may easily become insufficient, as well as in slight, inextensive hemorrhages into the brain, attacks of syncope are not infrequent.

Treatment.—The treatment of syncope must, in the first place, aim to improve the circulatory disturbance in the brain and to stimulate the diminished action of the heart. Our first measures therefore will be to place the patient in a horizontal position, unfasten all constricting clothing, supply fresh air, and stimulate respiration by cutaneous irritation. If the loss of consciousness is deep, artificial respiration will be indicated, and a Pravaz syringe of camphorated oil (1:10) or spirits of ether should be injected subcutaneously. In light cases, analeptics may be given internally, thus: Spiritus ætheris compositus, in adults, 10 to 20 drops, in children 5 to 10, or camphor, in adults 0.05 to 0.5 gm. and in children up to 0.1 gm. By inhalation of amyl nitrite, 1 to 5 drops on a handkerchief, the vessels may become dilated, or the patient may inhale ammonia to remove the syncope reflexly. A very vigorous stimulant, sometimes of excellent effect, is the introduction of physiological salt solution, 300 to 500 c.c.; and autotransfusion is to be recommended. Consciousness is usually regained of itself in a short time. Longer persisting loss of consciousness is due to a severe primary condition.

Sinus Thrombosis.—*Occurrence.*—Not only the arteries, but also the veins and capillaries may be the seat of thrombosis, but only the sinus thrombosis has a definite symptom-complex. It develops:

1. In marasmus and cachexia, in convalescence after exhaustive diseases, and also in infants after profuse diarrhea.
2. In chlorosis and anemia.
3. Following trauma, and then often complicated with meningitis.
4. Transmitted from the ear, nasal cavity, orbit, erysipelas, and phlegmon of the face, and brain processes as abscess and purulent meningitis.
5. From metastasis in acute exanthems and in peripheral processes.

Symptomatology.—If sinus thrombosis develops, fever, chills, headache, vomiting, epileptiform attacks, convulsions, delirium, somnolency, and coma are superadded to the symptoms of the primary disease.

Diagnosis.—The diagnosis is aided by edema variously localized according to the seat of the thrombus, thus on the back of the ear, or on the forehead in thrombosis of the longitudinal sinus in severe chlorosis. Epistaxis, dilatation of the retinal veins, and of the collateral venous plexus are valuable signs for the diagnosis.

Prognosis.—The prognosis is serious, but not always absolutely infaust. Only the chlorotic and septic thrombosis have usually a rapidly fatal termination. Infected septic thrombi sometimes lead to embolic pulmonary abscess.

Treatment.—In marantic thrombosis the treatment will be chiefly stimulating. In that of the lateral sinus due to ear affections life may be saved in almost one-half of the cases by operation. Every sinus thrombosis demands an elevated position of the trunk, which renders the venous outflow easier. Horsley advocated ligation of the jugular vein on the affected side to prevent the formation of pulmonary emboli. If a sinus thrombosis develops in infants the large fontanel becomes retracted at the time of onset, but later on protrudes, owing to the venous stasis and the increased intracranial pressure. This observation may aid in the differential diagnosis from hydrocephaloid (v. Leube).

Hyperemia of the Brain.—Cerebral hyperemia cannot be diagnosed with certainty, since conditions which may lead to it usually cause intoxication at the same time, and by the action of the toxic substances on the cerebral cortex the identical symptom may be brought about, for instance, a chronic nephritis with increased blood pressure, on the one hand, a uremic toxicosis, on the other. Active, congestive hyperemia results from intoxication with alcohol, ether, amyl nitrite, nitroglycerin, coffee, etc. Its existence is also assumed in an irritated action of the heart, and hypertrophy of the left ventricle, and in

insolation. Its action on the sensorium is chiefly an irritative one, whereas the passive hyperemia found in severe pulmonary empyema, in large goiters and in tumors of the mediastinum compressing the veins of the neck and thorax, in tricuspid insufficiency and whooping-cough, has a depressing action on the mental life; here no subjective sensation of heat, no pulsation of the carotids is present, as in active hyperemia, and the patient becomes somnolent or even soporous. On pressure of a brain tumor on the vena magna Galeni, deep coma may arise, but the effect of the increased intracranial pressure here cannot be distinguished from that of passive hyperemia.

Treatment.—The cerebral hyperemia of old people demands careful attention on account of the danger of an apoplectic attack. The same treatment as in the latter condition will therefore be indicated. Passive hyperemia is most effectually combated by improving the circulation. Digitalis, aided by an elevated position of the trunk and by local blood-letting will be found effective. Laxatives and a stimulating enema have been found to act promptly.

For enema, Henschen recommends the following:

Rp.	Olei olivarum,	
	Olei terebinthinæ æther,	āā 30.0
	Aquæ fontis,	300 to 400.0

In children suffering from pertussis narcotics are indicated, as an accumulation of the attacks increases the venous stasis in a dangerous manner; these medicaments have usually to be avoided in depressing disturbances of consciousness. If the pressure of a tumor causes a retrograde stasis of the venous system, the surgeon may give relief if the tumor is accessible to the knife.

Edema of the Brain.—In edema of the brain the same diagnostic difficulties arise as in hyperemia of the brain. It is impossible to decide if cerebral edema or a beginning uremia produces the nervous symptoms in the course of a nephritis associated with dropsy.

Acute Delirium.—Acute delirium, according to Kraft-Ebing, is another form of hyperemia of the brain. He sees in this psychosis the reaction of a brain, injured in its vascular tonus, to the influences causing the hyperemia, as alcohol, heat, and mental emotions. After prodromal symptoms, consisting in irritability, anxiety, and a state of congestion, there follows violent delirium which leads to mania. The delirium becomes muttering in a few days, picking at the bed-clothes, and sopor appear, and ten or twelve days after the onset of the disease death follows in deep coma. Derivation to the intestines and an ice-bag on the head may be tried; also an ergotin injection may be given to overcome the excessive hyperemia which, however, usually terminates in an acute periencephalitis.

Encephalitis Acuta Nonsuppurativa.—Another group of disorders attacking chiefly children, but also young adults, and leading to disturbance of the consciousness, may be comprised under the term acute nonsuppurative encephalitis. In the course of typhoid fever, small-pox, and polyarthritis, symptoms of irritation, as well as paralysis and coma may be observed, due to multiple hemorrhagic foci in the brain. Acute encephalitis is also observed in epidemic cerebrospinal meningitis. The acute primary hemorrhagic encephalitis (Leichtenstern) leads very rapidly to disturbed consciousness, rarely, however, to deep coma, so that patients usually react to powerful stimuli. Also the pupillary reaction is retained. In certain intoxications, meat, fish, sausage, and in chronic alcoholism, Wernike observed hemorrhagic encephalitis, associated with ophthalmoplegia and somnolency. Its analogy with acute anterior poliomyelitis was expressed by Oppenheim in the term polioencephalitis acuta hemorrhagica superior. The disturbed consciousness may exist from the beginning. It may be mentioned that an encephalitic focus in the pons may develop with a slight disorder of consciousness; in the medulla oblongata (acute bulbar myelitis), entirely without it.

Chlorosis and ulcerative endocarditis, too, may lead to encephalitis. The first three years of childhood are undoubtedly predisposed to this affection. The hemiplegic and diplegic spastic paralyses of children develop with severe vomiting, disturbed consciousness and convulsions. This condition may last a few hours or weeks and a veritable *état de mal* may develop as in severe epilepsy. Also acute anterior poliomyelitis may, in the beginning, present the picture of a severe cerebral disease. The diagnosis of all these conditions in the beginning often meets with insurmountable difficulties. The treatment is rather uniform: derivation to the intestines, dry or bloody cupping, ice-bags on the head during the acute stage, electricity, massage, and orthopedic procedures in the later stages.

Brain Abscess.—Abscess of the brain only toward the fatal end of its long-continued course leads to insensibility. The differential diagnosis from brain tumor is aided by presence of fever and chills, the absence of bradycardia, and of epileptic convulsions and choked disk. For the increase in the intracranial pressure is not as pronounced in abscess as in tumor. Acute abscess of the brain leads to coma, with violent symptoms, fever, delirium, and convulsions. The picture often resembles meningitis, and, in fact, both processes may exist together. The diagnosis should be considered when there is a possibility of infection:

1. By contiguity, from affections of the ear and orbit and in injury to the skull.

2. By metastasis, in bronchiectasis, empyema, pulmonary abscess,

and in the course of a typhoid fever or pyemia. It is important to know that the same picture may be simulated in children by a retention of pus in the tympanic cavity or in the air spaces of the mastoid process. Paracentesis of the ear-drum or the drainage of pus foci in the mastoid cells may bring about rapid improvement, removing all suspicion of a cerebral affection. If the diagnosis of the brain abscess and its situation are ascertained, operation is absolutely indicated, even on complication with sinus thrombosis, circumscribed meningitis, and beginning pyemia. If the primary disease is absolutely fatal, a diffuse meningitis or a severe pyemia, one will of course not insist on operation. The chances of surgical intervention are generally very favorable. Macewen lost one out of twenty-four cases—a very remarkable result in an affection of otherwise absolutely fatal prognosis.

Brain Tumor.—Brain tumor leads to disorders of consciousness sooner or later according to its course. At onset patients have difficulty in collecting their thoughts; they become lethargic and can sleep for weeks with slight interruptions. This is probably the result of increased cerebral pressure, other symptoms of which, as headache, vertigo, vomiting, choked disk, and slow pulse, are usually present at the same time, beside focal symptoms depending on the seat of the tumor. Deep coma may appear if the hydrocephalus increases suddenly or if a congestion of the vessels is brought about or hemorrhage into the tissue of the tumor. This last condition occurs very easily in glioma.

Disturbances of consciousness may also develop in brain tumor in the course of epileptiform attacks which occur in advanced cases of the tumor. Whereas in genuine epilepsy consciousness is lost immediately on the onset of the attack, here convulsions often set in with a sensorium entirely intact. They are at first unilateral and later become general, followed by loss of consciousness. Radical operation promises a favorable prognosis for permanent recovery only in tumors located in the motor region. But also palliative operation is justified in cases where the brain pressure is especially tormenting and blindness threatens. We may consider:

1. *Lumbar Puncture.*—The patient is placed on the side, the legs are retracted strongly against the abdomen and the back is in maximal flexion. The French physicians prefer the sitting position of the patient. After disinfection of the lumbar region the needle is introduced between the second and third lumbar vertebræ; in children in the median line, in adults 1 cm. from it, between the transverse processes. The conus terminalis reaches in the adult to the second, in the infant to the third lumbar vertebra. It is therefore advisable in infants to choose the interspace between the third and fourth lumbar

vertebræ. The French use the interspace which lies in the horizontal line between the crests of the ilia. This is often the third, more rarely the fourth interspace. The needle is introduced 4 to 7 cm. in adults and 2 to 3 cm. in children. When the dural sac is reached the mandarin is withdrawn from the needle and the liquid is allowed to flow out until it begins to ooze slowly. If more liquid is allowed to escape, the patient complains of headache, vertigo, and nausea. Stintzing advises interruption of the procedure as soon as the pressure sinks below 120 mm. The measure of the pressure is very simple: a glass tube is attached to the canula by means of a rubber tube and the vertical column of the cerebrospinal liquid above the point of insertion gives the pressure in millimeters of water. If the cannula is introduced into the dural sac, but no liquid oozes, then either no increased pressure is present or a terminal filament lies before the opening of the needle or the cannula is otherwise obstructed. By pushing the cannula forward and backward or by introducing the mandarin we may sometimes overcome the obstacle. Accidents occur very rarely; they consist in manifestations of meningeal irritations, as vertigo, pain in the head and neck, and vomiting, appearing within a few hours, and disappearing within a few days, leaving no traces. These complications are probably not due to the decreased pressure nor to infection; for they either would develop faster or be associated with fever, and then would certainly not be of such benign character. The most probable explanation is that it is a disturbance of the nutrition of the brain. In tumors of the posterior occipital fossa, lumbar puncture may result fatally in this way, that by a displacement of the cerebellum the aqueduct of Sylvius may become blocked. Beside the pressure of the liquid, its aspect whether clear or turbid, is important. In tubercular meningitis it may be clear as water, forming a cobweb-like fibrin net on standing a few hours; tubercle bacilli are found not infrequently.

In regard to the cytodiagnosis, inaugurated by Widal, it may be said that the liquor is almost free from cells in the normal state, and in neurosis, psychosis, central and peripheral diseases with meningism, and in brain tumors. In progressive paralysis, on the other hand, in incipient tabes and meningomyelitis, a lymphocytosis is found; in tubercular meningitis first polynuclear and later mononuclear leukocytes, providing no secondary infection has occurred. In epidemic cerebrospinal meningitis polynuclear leukocytes govern the picture; in chronic cases and in those in the process of healing mononuclear leukocytes appear, but on any exacerbation the polynuclear form reappears. By slitting the dural sac Quincke endeavored to accomplish a permanent diminution of the pressure; the lancet is introduced in the same way as the needle, but one interspace deeper. Edema of

the lumbar region announces the percolation of the spinal liquid. This procedure had to be abandoned on account of the great danger of infection. The effect of lumbar puncture in brain tumor and in hydrocephalus is only temporary; lasting results are seen in acute serous meningitis, and even in the sero-purulent form, by relieving the vessels and furthering resorption. In abscess and hemorrhage of the brain lumbar puncture may act favorably, but also may lead to perforation of the abscess or to a renewal of the hemorrhage.

2. *Puncture of the ventricle* with or without trepanning, as, for instance, in echinococcus cyst which has thinned the bone by pressure.

3. *Palliative trepanning.*

4. Trepanning followed by radical or partial *extirpation* of the tumor.

Syphilitic Diseases of the Brain.—Syphilitic diseases of the brain and of its membranes frequently cause disorders of consciousness.

Forms.—1. The syphilitic, basal meningitis is often accompanied by somnolence, by violent nocturnal headaches, attacks of vertigo and vomiting. Complete loss of consciousness may develop transiently, due to an attack of syncope, or may exist as coma for a long period. Fournier relates a case in which coma was the only symptom of brain syphilis. In other cases the immediate change from a clear sensorium to coma is striking, and it is just this rapid transition which is characteristic for the specific meningitis. Attacks of sleep are of unfavorable prognosis, for they are in some cases followed by death. Heubner and Wunderlich mention the frequency of masturbation in the deep sopor of specific meningitis.

2. Syphilitic arteritis may lead to loss of consciousness in various ways. The insufficient supply of blood to the brain, owing to the constriction of the vessels, may cause it; thrombosis of the Sylvian artery, from encephalomalacia of the internal capsule, may produce a hemiplegia which usually is associated with somnolency. Apoplectic attacks are more rare and are due to the rupture of small multiple aneurysms of the cerebral arteries.

3. Syphilitic meningoencephalitis is localized on the convexity of the brain, and is either diffuse or circumscribed; headache, tenderness of the skull on percussion, vomiting, vertigo, cortical epilepsy, psychosis, and sopor compose the picture of the condition.

Diagnosis.—The diagnosis of cerebral syphilis is aided by two factors: the changes in the intensity of the morbid symptoms and the effect of the antisyphilitic treatment. Carcinoma, sarcoma, and tubercular meningitis pursue an uninterrupted course. If in the course of the tubercular meningitis the sensorium has once become troubled, it never becomes clear again, which may be the case in syphilitic meningitis.

Prognosis.—The prognosis is not unfavorable before the fortieth year of life, but becomes gradually worse at more advanced age.

Treatment.—The treatment in these cases must be very energetic. Even marasmus is here no contraindication to the inunction treatment, which should last for six or seven weeks, and should be combined with large doses of sodium iodid internally. Some physicians give as much as 10 gm. a day or more, but 3 to 5 gm. will be found sufficient. Naunyn accomplishes marked results with this dose after a few weeks. Gummata may be operated, ending in recovery in one-third to one-half of cases. Adhesions on the convexity of the brain following luetic meningitis, have been extirpated by Horsley and Macewen with the view of removing cortical epilepsy.

Lues Cerebri Hereditaria.—Hereditary syphilis may lead to diseases of the brain, and indeed some cases of congenital hydrocephalus may result from such an affection, though they do not respond to the antisyphilitic treatment. Loss of consciousness is, however, only observed in syphilitic meningitis which may be exudative or gummatous, and in the latter case of basal localization. Relapses rarely involve the meninges, rather the vessels; and, by endarteritis, lead to epilepsy, hemiplegia, and diplegia, which may be associated with disturbance of the sensorium.

Hydrocephalus.—The acute nonspecific hydrocephalus is an affection of infancy and early childhood, which is rather difficult to diagnose. The acute, infectious gastroenteritis of infants is considered its most frequent pathogenic factor. Restlessness and gnashing of the teeth introduce the scene; the pulse and respiration become irregular, spasms of the glottis, tonic and clonic spasm of the extremities, strabismus and inequalities of the pulse may develop. The fontanel protrudes, the sutures are widely separated, and the circumference of the skull is increased. Finally, the pupils cease to react and become large and the child dies in coma, if a standstill does not occur with a change into the chronic form. The picture is so little typical that any rapidly developing diminution of the intracranial space, as in meningeal hemorrhage, may give rise to error.

The treatment of the acute hydrocephalus is as unsuccessful as that of the chronic form, which with coma and convulsions may lead to death.

Congenital hydrocephalus is usually internal. The ventricles of the brain are greatly dilated and may contain from 1 to 5 liters of a clear liquid, poor in albumin and rich in salts. The convolutions are flattened out, the brain substance is very much compressed. The skull is enormously enlarged, measuring 50 to 80 cm. or more, the bones are diastatic, the eyeballs are pressed downward, and there usually exists a certain degree of imbecility, but not always; the

extremities, especially the lower, are spastically paretic. In the pathogenesis of congenital hydrocephalus must be considered alcoholism and nervous diseases of the parents and the hereditary disposition. The prognosis depends on the enlargement of the skull. In slight cases, the intelligence improves with time, but in severe forms the patient scarcely learns to walk and talk.

The treatment is not very effective. Iodin and mercury may help in specific cases. The best results are still obtained by repeated systematic lumbar puncture. The difficulty lies in making the diagnosis at the right time, for the enlargement of the skull may be so slight that it may still be within physiological limits and only recognizable by a rapid increase in size. Attacks of screaming and laryngospasm exist, but otherwise no signs of congenital syphilis. Severe syphilitic changes of the brain and its membranes may run an entirely symptomless course.

Hydrocephaloid.—Hydrocepholoid, or Marshall Hall's disease, must not be confused with hydrocephalus. It develops in the course of severe gastroenteritis in infants, as a result of the dehydration of the organism. Consciousness may be disturbed, but the pupils react normally though sluggishly; the fontanels are deeply retracted, but no stiffness of the neck is present. Large quantities of physiological salt solution must be infused; its action is less effectual in the fully developed condition than if used prophylactically.

Multiple Sclerosis.—Also in the course of a multiple insular cerebrospinal sclerosis apoplectiform and epileptiform attacks may occur. The diagnosis is only possible after the attack has ceased, but it may be suspected from the anamnesis gained from the patient's family. These attacks are not followed by severe anatomical disorders, and disappear usually after one to two days.

Meningitis.—*Forms of Leptomeningitis.*—Diseases of the meninges exert an unfavorable influence on the sensorium. According to the pathogenesis and the anatomic changes, we distinguish the following forms of leptomeningitis:

1. The epidemic cerebrospinal.
2. The noninfectious serous.
3. The rheumatic suppurative.
4. Tubercular.
5. The ventricular, as acute hydrocephalus.
6. The transmitted and metastatic.
7. The traumatic.

The ventricular meningitis has been treated under Acute Hydrocephalus. The transmitted form may originate in ear effections, suppuration in the orbits, erysipelas, phlegmon, carbuncle, and furuncle of skull or face. Metastatic meningitis may follow furuncles

ad anum, and measles, scarlet fever, and pneumonia. Coma is usually not deep or complete, but if it has once appeared in a purulent meningitis it is scarcely possible to combat it. An affection of the convexity leads to a disturbed sensorium sooner than at the base. A suddenly appearing coma, resembling an apoplectic attack, has been reported in tubercular meningitis by Biermer and Huguenin. It deserves mentioning that pneumonia, involving chiefly the upper lobe, can often scarcely be distinguished from meningitis (cerebral pneumonia). Typhoid fever also causes frequent meningeal manifestations, but the Widal reaction and the blood culture will in most cases solve diagnostic doubts.

Treatment.—In epidemic and serous meningitis lumbar puncture often gives excellent results, for it stimulates resorption in the same way as this is observed in pleural exudates after puncture. In the tubercular form only a temporary improvement can be expected. If the communications between the dural sac and the ventricles are open, the increased pressure may be relieved by the removal of even 10 c.c. of fluid. Persistent drainage, by opening the spinal canal through the removal of the vertebral arches, has not brought about the expected results. In circumscribed purulent meningitis surgical intervention may save the life. In the epidemic cerebrospinal meningitis Flexner's specific serum should be tried.

Meningeal Apoplexy.—Among the meningeal affections leading to coma, meningeal apoplexy must be mentioned. Some cases of asphyxia in the new-born are, in fact, due to meningeal apoplexy, leading to pressure on the brain and paralysis of the respiratory centers. If, from trauma, hemorrhage from the middle meningeal artery has resulted, the first loss of consciousness due to the concussion may be followed by a free interval of hours or days, until the sensorium is again troubled by the increasing cerebral pressure. Trepanning and ligation of the bleeding vessel may save the life in an otherwise hopeless case.

Pachymeningitis Hemorrhagica Interna.—As a hematoma may develop outside the dura, it may also originate subdurally, usually on the basis of an internal hemorrhagic pachymeningitis. The etiology is various: Paralytic and senile dementia, marasmus, syphilis, chronic Bright's disease, various blood diseases, typhoid fever, small-pox, and icterus gravis, but above all, chronic alcoholism. The symptoms are polymorphous, and are generally caused by the increased pressure. Choked disk is constant, the pupils are contracted in the coma, the temperature excessively increased, and convulsions and paralysis may develop. It is very characteristic that the symptoms develop either very gradually or else in attacks, a behavior which finds its explanation in the anatomical changes. Hasse found great variations

in the intensity of the manifestations, but this is also found in other diseases leading to loss of consciousness, as tumor and edema of the brain and venous thrombosis. The treatment in the traumatic form consists in trepanning and lumbar puncture; in the inflammatory forms one will try to exert some influence by the application of ice, the local removal of blood, and derivation to the intestines.

Hematoma of the Dura in the New-born.—The dural hematoma of the new-born usually develops from compression of the skull during labor and the resulting overlapping of the bones. Compression of the cervical vessels by the umbilical cord wound around the neck or from congenital goiters may lead, especially in premature children with thin vessel walls, to intracranial hemorrhages. The hemorrhage is usually localized on the convexity, and only rarely on the base of the brain. Retardation of the pulse, sopor, and superficial respiration develop. The fontanel protrudes, differing in this way from its behavior in simple asphyxia, a sign of great importance for the treatment, as Schultze's swinging movements might act injuriously in such cases from the concussion, and therefore should be replaced by careful artificial respiration. A rupture of the sinus, an absolutely fatal lesion, may be produced by trauma during birth. Sometimes the symptoms recede, but a pachymeningitis develops, leading later on to renewed hemorrhages.

Epilepsy.—*Differential Diagnosis between Genuine and Symptomatic Epilepsy.*—We have to distinguish idiopathic and symptomatic epilepsy. The latter occurs in the course of a tumor or abscess of the brain, of multiple sclerosis, or of progressive paralysis; consciousness is not lost very rapidly in this form; aura as well as the epileptic cry are more frequently absent than in the genuine form. Cerebral pressure and focal symptoms may be demonstrated in the intervals.

The genuine epilepsy usually develops before the twentieth year of life in individuals with an hereditary tendency. In individuals so disposed epileptic attacks may be incited by scars, foreign bodies, tumors, inflammatory infiltrations, intestinal parasites, hernia, and sexual affections; such attacks heal if the noxa is removed. Alcoholic epilepsy develops in drunkards predisposed to it in the early stage of chronic alcoholism; it disappears on abstinence, only to reappear on any relapse to the old vice. Such an attack sometimes precedes delirium tremens. If epilepsy develops at a later age, one must think of a poor supply of blood to the brain, due to arteriosclerosis or cardiac diseases, or to alcoholism, lead-encephalopathy, diabetes mellitus, and syphilis of the brain. The classical epileptic attack does not need to be described here, but the atypical seizures associated with benumbed sensorium and often with the eruption of sweats sometimes cause difficulty in diagnosis.

Treatment.—The treatment during the attack itself must be restricted to a proper position for the patient and the removal of constricting clothing. The patient must be kept in bed after the attack. If there is any probable relation with acquired or congenital syphilis, antisyphilitic treatment must be introduced, which will be more effectual in syphilitic affections of the bones, meninges, cerebral vessels, or of the brain itself than in epilepsy due to parasyphilitic affections, as, for instance, tabes. In some cases the attacks develop soon after going to sleep, due to fluxionary hyperemia. In these cases the last meal should always be small. In other patients, a cerebral anemia may develop toward morning, owing to the long abstinence from food, and cause an attack. It is well for such patients always to eat something in the night. Some recommend that meat diet be avoided, but not much is gained by it. Alcohol is, at any rate, contraindicated, since all epileptics have a high degree of intolerance for it. The treatment with bromids, continued for months and even for years, is of undoubted value. It must be given in large doses, so that fatigue is produced, and the retching reflex is extinguished. Children of four or five years receive 1.5 to 2 gm. potassium bromid; children, ten to fifteen years, the dose for adults, 4 gm. *pro die.* If it is necessary to give large doses the patient is preferably taken to a sanatorium, where he will be under observation. Sodium bromid is to be preferred to potassium bromid. Flechsig advises giving opium in increasingly large doses for six weeks before the treatment with bromids is begun; however, it will be found advisable to reduce his doses, and in adults to begin with .03 gm. opium, in powder form, three times a day, and to increase .02 gm. *pro die.* In children under six years one must be very careful, beginning with 0.005 gm. as the daily dose, and only increasing it to 0.06 gm. The patients are best kept in bed, especially the children, to avoid collapse. After the conclusion of the opium treatment, bromids should be given in large doses. During the treatment with bromids the diet should be poor in salt, as this increases their action. Mild hydrotherapy, consisting in warm protracted baths with cold showers, brine baths, and the galvanic treatment of the head and cervical sympathetics with weak currents, will aid the treatment in an effective manner.

If epileptogenous zones exist, from which by pressure or electric irritation an attack or at least aura symptoms can be produced, operation, consisting in the removal of the changed tissue, is indicated.

Binswanger approves of surgical intervention only in pure reflex epilepsy; in cases of traumatic origin trepanning seldom gives lasting recovery, though often transient improvement.

The status epilepticus (*état de mal*) consists in a series of attacks

so near together that consciousness is persistently lost, though there are short intervals between the convulsions.

Obersteiner distinguishes a convulsive stage, with long-lasting, gradually decreasing symptoms of motor irritation, together with hyperpyrexia up to 44° C., the absence of reflexes, and difficulty in swallowing, due to paralysis of the upper part of the pharynx. This is followed by a stage of exhaustion, a condition of deep stupor, sometimes interrupted by muttering delirium. In this second stage death may occur from pulmonary edema or paralysis of the heart.

In the first stage enemas of chloral hydrate should be tried, until the spasms cease, and in the second stage the warm pack and the usual analeptics. The patients must be fed by sounds, in order to avoid aspiration pneumonia.

Hysterical Attacks.—Hysterical attacks may be distinguished from epilepsy by the following points. The consciousness is never completely lost in hysteria, but is only altered, being connected sometimes with the consciousness of the second attack (double consciousness). Emotional states exist during the attack. It is further characterized by coordination of the movements, the normal reaction of the pupils, and avoidance of all injuries. The disturbance of consciousness is not as intense as in epilepsy and usually lasts much longer. Karplus has recently proved that even in purely hysterical attacks the pupillary reaction may be absent at the height of the condition, and that the consciousness may be entirely extinguished during the "grande crise." Of hysterical disorders of consciousness, lethargy, a form of pathological sleep, deserves mentioning. All other symptoms of coma, as stertor or Cheyne-Stokes respiration, are absent. In catalepsy any voluntary motion is impossible, but the sensorium is intact.

Paralytic Attacks.—In the course of progressive paralysis apoplectiform and epileptiform attacks may be observed, but usually they pass again rapidly.

Ménière's Disease.—The action of the sensorium in Ménière's disease is not entirely clear. Charcot denied any troubling of consciousness when the patient falls to the floor. If the disease sets in from complete health, there is a transient loss of consciousness, from which the patient wakens with vomiting, staggering, vertigo, and continual hardness of hearing. This picture points to a hemorrhage in the labyrinth, and may develop after trauma, which has caused fractures in the petrous portion of the temporal bone. Attacks of nausea and loss of consciousness in patients who previously have suffered from partial deafness, vertigo, and tinnitus must be distinguished from the above condition.

Eclampsia of Infants.—*Explanation of the Tendency to Spasms in*

the First Years of Life.—The tendency to convulsions in the first three years of life was explained by Soltmann by analogy with young animals, in which, if younger than ten days, the centers of reflex inhibition were not developed. Henoch objects to this view, because the disposition to spasm persists too long to be explained in this way. Not all spasms are accompanied with loss of consciousness; in true tetany the sensorium is always intact, as well as in persistent, tonic rigidity, but it is involved in eclamptic and often in the laryngospastic attacks during convulsions and tonic intermittent spasms.

Forms of Eclampsia.—Children of nervous parents and of such parents who have themselves suffered from spasms in childhood are the ones usually affected by eclampsia. Here belongs the hematogenous eclampsia of Soltmann, attacking certain children at the onset of acute infectious diseases. Measles may show eclampsia during eruption; small-pox during the eruptive stage and in the fever of suppuration; pyemia on the appearance of new suppurative foci. Not only bacterial toxins, but also other poisons which in adults do not readily lead to spasms may in children excite convulsions; thus alkaloids, alcohol, carbol, iodoform, and potassium chlorate.

Intestinal autointoxications in constipation and enteritis and parasites, ascarides, and tenias (during the treatment) may be the cause of such attacks; also Asiatic cholera and cholera nostras, in the first stage, by dehydration, and further by toxin action; rectal fissures, phimosis, hernia, and undescended testicles in the inguinal canal. Toxic and reflex causes may concur in the reflex eclampsia, in intestinal parasites, and burns of the skin. Injuries and severe psychical irritation may result in an immediate attack.

Symptomatology.—An attack of eclampsia infantum resembles very much an epileptic attack: at onset the face becomes pale, later on bluish-red, and severe asphyxia may develop. It is well to take the temperature in each attack, in order to decide if it is not a larvate attack of fever; thus any attack of malaria may simulate an eclamptic seizure. The venous stasis in the course of whooping-cough or in congenital heart lesion may call forth eclampsia; also the asphyxia of the new-born, where the enormous oversaturation of the blood with carbonic acid is another inciting factor, beside the venous stasis. The new-born may suffer from eclampsia in the course of an umbilical sepsis, a gastric enteritis or pneumonia, as well as in the congenital *debilitas vitae* toward the end. Children of eclamptic mothers are sometimes taken with eclampsia soon after birth.

Prognosis.—The prognosis of eclampsia due to gastroenteritis in young infants and to whooping-cough is unfavorable. Small hemorrhages have been recently demonstrated in the brain in the latter disease. With other etiologies the prognosis is good.

Treatment.—Henoch advises not to lose much time with other remedies during an attack, but to produce chloroform anesthesia at once. He pours a teaspoonful of chloroform on a handkerchief and has the child inhale it until it falls into a quiet sleep. Cyanosis is no contraindication, but collapse is. Sometimes, though rarely, chloroform does not act. It never heals the condition, of course, but it arrests the attack and time is gained in which to combat the primary disease and to prevent a repetition of the attack. Other antispasmodics which may be used without regard to the pathogenesis of the condition are chloral hydrate, in the form of an enema, containing 0.25 to 1 gm. to 100 Mucil. gummi. acac.; or bromipin (10 per cent.), as many grains as the child is months old, in 200 c.c. water, as enema. Chloral hydrate is also given internally in doses of 0.1 to 0.3 gm. dissolved in milk; it must be introduced by a stomach sound or a soft catheter through the nose. During the attack itself, luke-warm baths with cold showers, and on threatening collapse, analeptics and cutaneous irritation, and in hyperemia of the brain, blood-letting will be indicated. Compression of the carotids, advocated by Trousseau, arrests the attack in some cases, but no indication can be given for this procedure, as we are not informed as to the individual state of the cerebral blood supply.

Laryngospasm and Expiratory Apnea.—Concerning the laryngospastic inspiratory spasm and the expiratory apnea of children between the sixth and thirtieth months of life, the first condition leads to loss of consciousness on long duration, the latter at once. The latter is far more dangerous, often immediately fatal. The whole respiratory musculature remains in the position of expiration, and neither tracheotomy nor insufflation of air helps. The danger of these conditions does not lie in the disturbed consciousness, but in the asphyxia which is sometimes followed by an eclamptic attack. About 7 per cent. of children that have suffered from spasms become epileptics. The epilepsy of children does not differ from that of adults, only psychical disorders are more rare.

Concussion of the Brain.—Though concussion of the brain, usually of traumatic origin, belongs in the domain of the surgeon, it may here be considered in brief on account of the associated disturbance of consciousness. Trauma of the skull and its contents is often followed by unconsciousness of longer or shorter duration. It is by no means infrequent in concussion of the brain, a symptom-complex following the effect of blunt force, a fall, or blow on the head, without any demonstrable anatomical changes in the brain. Unconsciousness, pallor of the skin, vomiting, slow pulse, dilatation and absence of reaction of the pupils, and sometimes the involuntary passage of feces and urine are the most salient symptoms. The respiration is

slow and superficial. These manifestations cease gradually, usually within twenty-four hours, leaving behind a sense of heaviness and dizziness in the head. The most constant symptoms are the coma and bradycardia; vomiting may be absent.

In light cases the unconsciousness lasts only a few minutes and the bradycardia ceases after a few hours. In severe cases the coma lasts hours or days, the frequency of the pulse sinks to 30 beats in the minute, and the feces and urine, at first discharged involuntarily, are in the further course retained. The patient gradually regains his consciousness, but he remains in a dazed condition from which he recovers slowly to clear mental activity. Characteristic is the retrograde amnesia—"the complete absence of all memory for the perceptions and ideas which he had before the injury" (Gussenbauer). There sometimes follows a state of irritation, with hyperemia of the face, restlessness, and headache. Albuminuria and glycosuria may be transitory symptoms of brain concussion. In severe cases death occurs during coma. Duret, and later Gussenbauer, explained the phenomenon of concussion as due to the sudden displacement of the cerebrospinal fluid, which causes an irritation of the ventricular walls.

Diagnosis.—The diagnosis will depend on the anamnesis, on the symptoms mentioned above, and on possible lesions of the skull. Some patients, believed to have died from commotio cerebri, have in fact succumbed to internal hemorrhage. Unconsciousness may also follow rupture of the middle meningeal artery from trauma; the symptoms resemble those of apoplexy, but the loss of consciousness develops very gradually.

Treatment.—The treatment of concussion of the brain has to fulfil two indications. First, the arterial anemia of the brain must be combated by placing the head in a low position, but this must be interrupted for some time if cyanosis of the skin of the face and the mucous membranes announces hyperemia of the brain. Then the manifestation of reaction must be treated; in this the first requirement is absolute rest in bed and the avoidance of all excitement from visits, etc. An ice-bag on the head, derivation to the intestines and to the skin is to be recommended.

INTOXICATION AND AUTOINTOXICATION AS CAUSES OF LOSS OF CONSCIOUSNESS

General Remarks

Above all, narcotic poisons are accompanied with loss of consciousness, but in almost any severe acute intoxication the sensorium may become troubled eventually. Chemical noxæ introduced from without may lead not only to local injury, which according to the

mode of incorporation involves various organs, but may also produce general manifestations. Coma is the last act of a varied scene; and, therefore, a presentation of intoxication which would only consider the central nervous system would be quite inadequate. Thus, in order to understand fully the morbid changes in poisoning, it is indispensable to discuss a few general questions.

The poison incorporated may, to a large extent, be excreted by the urine, the feces, by vomiting, by the sweat, and by other glandular secretions. Even poisons not introduced per os, as sublimate, may be excreted by the intestinal mucosa. The organism renders many poisons innocuous by chemical means: free acids and bases are transformed into salts, other substances are rendered harmless by processes of reduction, oxidation, and decomposition, and even by synthesis. Biologically very interesting are the conjugations with sulphuric, glycuronic acids and glycocol for neutralizing the poisonous action. All these means of defense serve as models for our therapeutic measures. The organism possesses an organ especially adapted to neutralizing poison, the liver, whose mode of action is not, however, completely understood.

General Symptomatology

General symptoms of intoxications are:

1. Vomiting and diarrhea; even after subcutaneous poisoning, as with arsenic acid or pilocarpin.

2. Fever (phosphorus, spasmodic poisons, carbon monoxid).

3. Subnormal temperature and subjective sensation of cold, chills.

4. Palpitation, acceleration, retardation, and arrhythmia of the heart action.

5. Congestion, cyanosis, pallor of the skin (from cardiac weakness), oversaturation of the blood with carbonic acid, formation of an abnormal coloring matter in the blood, as methemoglobin in poisoning with potassium chlorate and antifebrin; anilin cyanosis.

6. Sweating, usually in collapse and therefore of unfavorable prognosis.

7. Motor disorders of the skeletal musculature, incontinence of urine and feces, abortion.

8. Disturbances of speech, localized in the cerebral cortex, peripherally, in the musculature, and even in the mucosa (the raw voice in atropin poisoning, due to dryness of the membranes).

9. Sensory disturbances.

10. Subjective and objective dyspnea, in its various forms; for instance, inspiratory in edema of the glottis following sublimate

poisoning; expiratory in paralysis of the posticus in the course of a chronic lead intoxication or in spasm of the diaphragm.

The symptomatology of itself does not always lead to the suspicion of intoxication, but the violent onset in complete health, the affection of several persons at the same time or possibly of domestic animals are characteristic of poisoning. The remains of the food and drink must be examined and the possibility of industrial intoxication or of such due to the use of toxic objects (matches) must be thought of. Some forms of poisoning may be recognized by the odor of the exhaled air (alcohol, amylene hydrate, paraldehyd).

Prognosis

The prognosis of intoxication depends chiefly on the possibility of removing the poison or of rendering it chemically harmless, and therefore on the time which has intervened since the poison was taken. Poisoning following subcutaneous or intravenous incorporation is the most unfavorable. Many intoxications do not lead to death, thanks to therapeutical intervention, but lead to chronic invalidism (arsenic, lead, phosphorus, etc.).

General Treatment

The first principle of treatment is the rapid removal of the poison from the stomach by lavage, and only in cases of necessity by emetics. These latter should not be generally used, because they increase the tendency to collapse and are ineffective if the reflex irritability is decreased; tartar emetic and copper salts especially have a weakening action on the heart. Lavage of the stomach is not indicated in cauterizing poisons, as there is danger of perforating the walls with the tube. If trismus exists, the stomach is washed out through the nose. One to 50 liters of water are used to wash out the stomach, and by means of chemical tests we may discover if the poison has been completely removed. By appropriate additions to the water the effect of lavage may be increased. If some time has passed since poison was taken, one must try to remove it by laxatives and high irrigation of the intestines. Laxatives act favorably, especially in difficultly resorbable poisons, as lead salts; certain cathartics are especially indicated for chemical reasons, as the sulphates of magnesium and sodium in lead poisoning. From the respiratory organs poisons are removed by supplying fresh air, sometimes by artificial respiration; from wounds, by squeezing or washing them out and by cauterization. If the kidneys are intact, elimination may be tried by these organs. Drinking large quantities of carbonic acid waters mixed with wine

is very effectual in producing increased diuresis. The organism may be washed out by infusion of physiological salt solution. This procedure may sometimes be combined with venesection. Sweat and saliva are less adapted to excrete the poisons. In general, it may be stated that some poisons are easily eliminated, as strychnin, and others only with difficulty, as morphin and chloral hydrate.

The chemical fixation of poisons must be tried. Acids neutralize alkalies and *vice versa;* barium salts may be precipitated as insoluble sulphates; oxalic acid and its salts as calcium salts. Animal charcoal absorbs many poisons, but only if it has been kept in air-tight vessels and if it is freshly burned from time to time. Tannic acid forms precipitates with the alkaloids and heavy metals; ferrous sulphide renders sublimate, ferrous oxide, and potassium cyanid harmless. There are also poisons which, without mutually influencing each other chemically, are antagonistic in their action on the organism. Thus atropin stimulates to beating the heart of a frog which has been paralyzed by muscarin. These physiological antidotes are extensively used, as atropin and morphin, pilocarpin, muscarin, cocain, amyl nitrite, salicylic acid, ergot, chloral hydrate, chloroform, ether, strychnin, santonin, digitalis, strophanthus, and other cardiac poisons.

There are a great number of symptomatic indications for therapeutical intervention. If collapse occurs, camphor, tea, coffee, wine, and ether aceticus are indicated. The head is placed low, the limbs rubbed, and sinapisms are applied to the thighs. A warm bath with cold douches on the neck is sometimes beneficial. In subnormal temperature heat must be supplied, and in respiratory paralysis artificial respiration must be introduced. It is also advisable in such cases to inhale ammonia, but never more than 15 drops. v. Jaksch prefers camphor injections to deepen the respirations, as he considers camphor the best general analeptic. In severe asphyxia the patient must be placed in a horizontal position, a pillow under the back, so that the head sinks down, and then one must try to revive respiration; several methods are in use. Perhaps the most effective is to place the hands on the costal arches and to compress the thorax about twenty times a minute. In this way cardiac massage is at the same time exerted to a certain degree, but if this is not desired the compression must be performed much more frequently—about 120 times a minute. Massage of the heart may be accomplished by placing the left hand under the patient's back and exerting with the right hand rhythmical blows on the pericardium. If trismus of a high degree is present, tracheotomy may become necessary, and air or oxygen will have to be supplied by a bellows. If respiration ceases, one may try faradization of the phrenic nerves, applying the electrodes on the posterior margin of the sternocleidomastoid muscle; after finding the nerve

as it passes over the scalenus muscle one sends through it a strong induction current for twenty-two minutes. Head, shoulders, and arms must be fixed, for the auxiliary muscles, irritated by this procedure, elevate the thorax, whereas otherwise they would bring the arms toward the trunk.

If the tongue has fallen back, the lower jaw is brought forward as in chloroform anesthesia by the manipulation of Heilberg, or a tongue retractor may be used. To improve the reflex irritability, injections of strychnin nitrate in doses of 0.003 to 0.005 gm. will be found very useful, as well as baths of 39° C. and cold douches on the neck. The cardiac activity may in some cases be stimulated by atropin.

Special Part

1. **Poisoning by Acids** (*Acidismus*).—By the term acidismus we comprise intoxication by acids introduced from without; while acids formed in the metabolism produce the morbid picture of acidosis. The sulphuric acid toxicosis may be described as a type of acid intoxication.

Sulphuric Acid.—Sulphuric acids produces brownish eschars in the mouth, pharynx, aditus ad laryngem, esophagus, and stomach. In children the acid may penetrate into the larynx, as the reflex action is insufficiently developed. Salivation, pain on swallowing, edema of the glottis, and vomiting of pulpy, black masses develop, followed by severe pain in the stomach, and in the further course by ulcerative enteritis and nephritis. The local manifestations may lead to perforative peritonitis, to traumatic infection with fever, and, if life is retained, to cicatricial strictures in esophagus and stomach. The blood loses in alcalescence, but not very pronouncedly, since it is soon neutralized by the ammonia. The diagnosis may be suspected from the sloughs and is verified by the test for sulphuric acid by barium chlorate; it is advisable to titrate the vomited matter with normal NaOH, as also the sulphates give the reaction.

The prognosis depends first on the quantity of acid swallowed, the lethal dose being between .4 to 5 g. Much depends, of course, on the possibility of immediate intervention. Large quantities of water, albumin, or soap water should be given; a suspension of bismuth magnesia acts even better.

Carbonates are not appropriate, as the carbonic acid formed dilates the stomach, thus augmenting the danger of perforation. In edema of the glottis tracheotomy may become necessary. The sequelae, as stricture of the esophagus, demand special treatment.

Nitric, Tartaric, and Hydrochloric Acids.—Other cauterizing acids have a similar action, but the sloughs have a different aspect. In

poisoning with nitric acid they are yellow (xantho-proteic reaction); with tartaric acid, white; and with hydrochloric acid, the mucosa looks as if scalded. Hydrochloric acid is difficulty demonstrated, as the normal gastric contents give the reaction in a less degree. In all intoxications with cauterizing acids lavage of the stomach is contraindicated, owing to the danger of perforation. Dilution and neutralization are the chief objects of the physician's intervention. The excrutiating pain in the stomach will necessitate the administration of opium or morphin.

Oxalic Acid.—Oxalic acid occupies a peculiar position, which is indicated by the toxicity of its neutral salts. The cauterizing and reactive inflammation are less marked, but the manifestations on the part of the central nervous system are pronounced, consisting of trismus, tetanus, and convulsions. Crystals of calcium oxalate by infarct formation in the kidneys lead to oliguria and even to anuria. Oxalic acid is characterized chemically by the production of CO on being heated or on being treated with concentrated sulphuric acid; the CO is recognized by the blue flame. Lavage of the stomach is possible with the addition of chalk-water; 100 gm. to 1 liter of water is indicated here.

Hydrocyanic Acid.—Intoxication with hydrocyanic acid kills usually before the physician arrives. The patient collapses on the floor with a cry and succumbs with tachypnea and convulsions. The hemoglobin is changed into CN-methemoglobin, and the catalytic action of the red blood-corpuscles is hindered, and the tissues lose the faculty of fixing and absorbing the disposable oxygen. The stomach must be washed out at once, H_2O_2 added to the rinsing fluids, since in this way the less toxic oxamid is formed; salt infusions may be useful and warm baths with cold showers; analeptics must be tried.

Poisoning by Lye.—Intoxications with lye commonly used for washing purposes about the house are very frequent. The picture resembles the picture with cauterizing acids, but the mucosa is softened and tumescent, the vomited matter is glassy, soap-like, often of brownish-red discoloration from the transformed hemoglobin and of strongly alkaline reaction. Also the urine becomes alkaline and contains much phosphoric acid, magnesia, and ammonia magnesium phosphate. Here also perforation peritonitis and stricture threaten, the latter developing here even more readily than after acid poisoning. Lavage of the stomach, therefore, is not advisable, but acids must be given for neutralization; for instance:

Tartaric acid,	5 : 100
Citric acid,	1 : 200
Acetic acid,	10 : 100

Opiates will have to be given for the pain. Children receive internally as many drops of the tincture as they are years old, or, in enemas, three times as many. Feeding by the rectum is difficult to accomplish in children and cannot prevent threatening inanition. Feeding by sounds may be omitted in lighter cases, as the patient may take food spontaneously after five days. In severe cases, however, we must wait with sound feeding for ten days, since the destruction of tissue is usually deep.

Ammonia.—Ammonia may be inhaled and then irritate the aerial passages so severely that a croupous inflammation with coughing up of membranes may be produced. It may also have been drunk in a watery solution. It is not only locally severely irritating, but is a nerve poison which may lead to chronic spasms, states of excitation, loss of consciousness, and even after ten minutes to fatal collapse.

Potassium Chlorate Poisoning.—Intoxication with potassium chlorate is often of medicinal origin, as doses which are permitted by the pharmacopeia may in some individuals produce symptoms of intoxication. Used in gargles, it has been frequently drunk. Physicians, therefore, have every reason to be cautious in prescribing and dosing it, especially with children. Local effects of cauterization are not present, but methemoglobin is produced in the blood, the color of the skin is yellowish and cyanotic, the urine is dark from the admixture of methemoglobin and hematin; severe nephritis, gastrointestinal disorders, spasms, delirium, and coma develop, and sometimes dyspnea and cardiac weakness. The demonstration of chlorates in the urine is made by heating it with concentrated HCl, whereby chlorin vapors pass off. This development of chlorin is the reason why acids should be avoided in treating this intoxication. The stomach should be thoroughly washed out and diuresis and diaphoresis stimulated. The whole organism may be cleansed by the infusion of physiological salt solution.

Barium Poisoning.—Barium compounds have been tried therapeutically to increase the blood pressure, but have since been abandoned. Adulteration of flour with heavy spar is a source of intoxication. The picture sets in with gastrointestinal symptoms, cramps, paralysis, and symptoms of circulatory disorders, which recall the action of digitalis. A motor weakness often remains for a long period. The stomach must be thoroughly washed out with a 1 per cent. solution of sodium sulphate, until barium sulphate no longer appears in the rinsing water. Colic and bradycardia must be relieved by injections of atropin. If the gastric juice has an alkaline reaction, the administration of dilute sulphuric acid, 1 : 200 water, will be indicated.

Silver Nitrate.—Pieces of caustic pencil are sometimes swallowed on medicinal cauterization of the pharyngeal cavity, an accident

which sometimes sets the patient as well as physician in a state of excitement, usually without cause. Lavage of the stomach with a 1 per cent. solution of salt is sufficient to prevent any harmful results.

Phosphorus Intoxication.—The dosis lethalis of yellow phosphorus, according to v. Jaksch, lies between 0.005 gm. and 0.1 gm., and therefore the heads of 100 phosphorus matches are sufficient for the fatal intoxication, whereas the red amorphous phosphorus contained in the Swedish matches is absolutely nontoxic. Very large doses of phosphorus may lead to convulsions, coma, and death in a few hours. Usually, however, nausea, vomiting, colicky pains in the abdomen, and headache set in after a few hours, followed by a sensation of weakness; these symptoms may be followed by a remission, and after a few days new symptoms appear, jaundice and fever, and subnormal temperature with unfavorable prognosis. The liver swells and becomes tender to pressure, but there is no enlargement of the spleen. In many cases fatty degeneration of the heart leads to death; sometimes a hemorrhagic diathesis or a severe nephritis are the preponderant features. In rarer cases, a picture develops similar to cholemia, with delirium, sopor, and coma. v. Jaksch found the alcalescency of the blood diminished. The later the jaundice appears and the less pronounced it is, the better the prognosis.

Diagnostic errors may arise, owing to confusion with acute yellow atrophy of the liver, but the rapid decrease in the volume of the liver and the tumor of the spleen enable us usually to recognize this condition. Puerperal sepsis may be differentiated from phosphorus poisoning by the chills and septic temperature. Poisoning with certain mushrooms may produce similar conditions, therefore the vomited matter and the feces should be examined for phosphorus. These substances are placed in a flask with two strips of filter-paper, one of which has been saturated with silver nitrate, the other with lead acetate. If the first strip alone becomes black, it proves the presence of phosphorus; if the second is also blackened, the test is infeasible from the presence of the H_2S (Scherer) The sovereign treatment for phosphorus poisoning is a thorough rinsing of the stomach with warm water until any odor of phosphorus has disappeared. This may be followed by rinsing with copper sulphate and burnt magnesia solutions. Copper sulphate has also been recommended by v. Bamberger as an emetic in doses of 0.1 to 1 gm. Other oxidizing agents are hydrogen peroxid in a 1 to 3 per cent. solution, old oil of turpentine or a 0.2 to 0.1 per cent. solution of the permanganate of potassium. All fatty foods must be strictly avoided for several days, as phosphorus is soluble in fat and in this way more easily resorbable. Phosphorus poisoning is therefore one of the few intoxications in which the administration of milk is entirely contraindicated. On the other hand,

injections of camphorated oil (1 : 10) are not only permitted, if the heart is weak, but entirely indicated (v. Jaksch).

Corrosive Sublimate.—As little as 0.2 gm. sublimate may produce death. The local cauterizing action is very pronounced in concentrated solution. The formation of eschars in the oral mucosa, the vomiting of necrotic mucous shreds and blood, profuse diarrhea, tenesmus, and, later on, ulcerative stomatitis, gastritis, and enteritis are the immediate consequences of the internal incorporation. There may be no nervous manifestations and death may occur with a clear sensorium, unless the very severe nephritis leads to uremia. It may be mentioned that stomatitis and the gray line on the gingiva, as well as the ulcerative inflammation of the large intestine, are also found in the external use of sublimate, as in vaginal douches. If a sufficient quantity of Hg is present in the urine, it may be precipitated in acid urine by introducing H_2S.

The treatment consists in the lavage of the stomach, as the firm sublimate scar involves no danger of perforation; in the administration of milk and of albumin: 13 parts milk render one part mercury harmless. Salt must be avoided, as it increases the solubility of sublimate. As chemical antidotes iron filings and magnesia may be used. Opiates for the abdominal pain, warm baths for the collapse, and mouth-washes for the salivation and stomatitis will assist the treatment.

The chronic intoxication with the vapors of mercury and with mercury compounds leads to marasmus, tremor, neuritis, psychosis, and contracted kidney, beside a number of affections of the skin and mucosa. The intoxicated individual must be removed from the region of the poison, otherwise the treatment will have to be purely symptomatic.

Arsenic.—The acute intoxication with arsenic resembles Asiatic cholera. It leads rapidly to the algid state (asphyxia arsenicalis), and, with paralysis of the splanchnic nerve and an enormous fall of the blood pressure, to death, in doses of 0.1 to 0.2 gm.

In order to demonstrate the presence of white arsenic in the vomited matter, it is sufficient to secure one of the white particles, and dissolve it in hot water; after cooling the arsenic crystallizes out as small octahedra; the urine also must be examined for arsenic. The treatment should begin with lavage of the stomach, followed by the internal administration of freshly precipitated ferrum oxydum hydratum, to which a little ammonia is added while warm. Of this antidote 2 to 4 tablespoonfuls are given every ten minutes. Much in use is the so-called Fuchs' remedy of the following composition: 15 gm. magnesia, 250 water; 100 gm. ferrous sulphate, 550 water; equal parts of these solutions are mixed and of the mixture 1 tablespoonful is given every ten minutes.

Chronic arsenical poisoning leads to cachexia, polyneuritis, mental disturbances, and melanosis of the skin; if this condition is suspected, the urine must be examined for arsenic, though an experienced neurologist will be able to distinguish clinically this picture from the similar one of chronic lead poisoning. Poisoning with arseniuretted hydrogen leads to death with hemoglobinuria, hematuria, jaundice, and spasm.

Lead poisoning in its acute form is rare. It is sometimes found in children from the excessive use of lead-containing ointments and plasters. Owing to the great excitability of the child's nervous system, convulsions appear readily. The acute intoxication of adults sets in in the following way: the patient feels a sensation of dryness in mouth and pharynx, colicky pains follow, as well as bloody vomiting, the pulse becomes slow and of high tension during the colic, but at other times accelerated. Lavage of the stomach with albumin and the use of alkaline sulphates, as a cathartic and as an addition to the rinsing water, will be the most effective measures.

Much more frequent is the chronic form of lead poisoning, one of the most common industrial diseases. There are rivers which contain lead and poison the sand and clay of a whole region, thus leading to the simultaneous poisoning of many people. Tin cans often contain lead and paprika is often adulterated with the red oxide of lead. In spite of the chronic course, the picture may be very violent at times. but the physician will be able to make the diagnosis even in the free intervals. The following factors will be important for the diagnosis:

1. The lead line on the gums; it must not be confused with the discoloration produced by black tooth powders or in intoxication with other metals, as mercury, iron, silicon.

2. The black discoloration of the skin on washing it with a soap containing sulphid.

3. The demonstration of lead in the urine, which is not always possible.

Lead colic may develop even within a few days after occupation with lead-containing colors; the patient writhes in pain, the abdomen is retracted, the pulse is retarded, the tension increased, the temperature usually subnormal, and sweat secretion absent. The attack may pass within fifteen minutes. In the pain we may give: Chloroform 2, syrup 60, 1 teaspoonful every one-half to one hour; or opium, 0.03 gm., every two hours; tincture of opium 20 drops every four hours or 10 drops every two hours; on uncontrollable vomiting, 30 drops of opium in enema. Riegel, believing that the colic is chiefly due to spasms of the vasoconstrictors, recommends amyl nitrite and pilocarpin. Atropin may be used. Warm cataplasms on the abdomen are beneficial. After the lead colic, arthralgia saturnina often devel-

ops, causing severe pain, chiefly in the flexor muscles of the lower extremities, and sometimes attacks of asthma with very intense dyspnea, and finally some manifestations of the central and peripheral nervous system, as paresthesias, paralysis of the radial nerve, and encephalitis (encephalopathic saturnina); some mental symptoms are usually associated with the latter conditions. Delirium and maniacal attacks, as well as convulsions and deep unconsciousness, the coma saturninum, may be observed. Disturbances of consciousness in lead poisoning may be due to the uric acid diathesis and to the contracted kidney with uremia (lead gout). The measures in combating the nervous symptoms in chronic lead poisoning are not very numerous or effective. One may give sodium iodid (5 : 150 aqu.), 1 tablespoonful three times a day; in this way a fall in the blood pressure may sometimes be accomplished, by the dilatation of the vessels, and the decreased viscosity of the blood. To remove the lead from the body one may give baths, to which 150 gm. sulphuretted potash has been added.

Copper Poisoning.—Candy, cucumbers, canned vegetables, and green liquors sometimes contain copper sulphate. Severe gastrointestinal disorders may be caused by it, followed by sopor and convulsions. Besides the symptomatic treatment, chemical antidotes should be used, magnesia usta, iron filings, on which metallic copper is precipitated from copper salt solutions, and potassium ferrocyanid, which precipitates the copper salt as copper ferrocyanid.

Carbon Monoxid Poisoning.—Coal gas contains from 7 to 10 per cent. carbon monoxid; charcoal fumes, 2 to 4 per cent. The symptoms of intoxication consist in dizziness, headaches, congestion, and sensations of anxiety and pleasure, followed soon by loss of consciousness. Vomiting often develops in this stage, threatening suffocation from aspirations; the temperature is at times subnormal, at others highly increased, the cardiac action is usually irregular. Trismus, tonic and clonic spasms may be observed, and, as sequelæ of the intoxication spontaneous and alimentary glycosuria, and albuminuria, chorea, poliomyelitis, and gangrene of the skin.

The CO-hemoglobin containing blood renders the exchange of gas impossible, and increases the decomposition of proteins. CO is tested spectroscopically or by boiling a sample of blood, diluted twenty times with water, to which some KOH has been added: a bright red color develops instead of a chocolate-brown if CO be present.

The treatment must aim, above all, at combating the asphyxia, either by artificial respiration or by the method of Laborde, who advises rhythmic contractions of the tongue about fifteen times in the minute. Oxygen inhalation or venesection, followed by the infusion of physicological salt solution, may be tried.

Poisoning with Hydrogen Sulphid.—Poisoning with hydrogen

sulphid is observed chiefly in workmen in mines and sewers. It is first announced by weakness and prostration, muscular twitchings, vomiting, and loss of consciousness. The hemoglobin of the blood is transformed into sulphomethemoglobin which can no longer serve in the exchange of gases. Death usually occurs before the chemical transformation has progressed very far. The administration of chlorin, better of chlorin water, is an antidote.

Chloroform Poisoning.—Disagreeable accidents in chloroform anesthesia may be prevented in part by using chemically pure chloroform—chloral-chloroform, or Pictet's purified preparation. It must be free from all decomposition products (HCl-phosgene gas), and it is therefore not advisable to give any anesthesia by gas light. A careful examination of each patient should be made before anesthesia; in tendency to collapse after severe hemorrhage, in fatty heart, in dilatation of the right ventricle, and myocarditis its use is dangerous; this is not true, however, for every form of cardiac failure. Many an accident may be avoided by careful observation of the patient during the anesthesia, but not all, since a single chloroform anesthesia may produce fatty degeneration of the liver and heart, leading to death. Several measures have been recommended to avoid these accidents.

1. Laborde cocainizes the nose, avoiding in this way, at least in the first stage, the reflex asphyxia.

2. Guérin, participating in the view that the nasal mucous membrane may reflexly cause a cessation of respiration, closes the nasal openings during anesthesia.

3. Special care must be taken in children who resist, and thus lead the anesthetist to press the cone too tightly against the face, shutting off in this way the access of air. In children whose cardiac force is unimpaired, anesthesia is easily performed, provided that care is exercised for a sufficient supply of air. It should be a rule to interrupt anesthesia at once at the onset of stertorous breathing; it is sufficient to remove the mask. In case of any severe asphyxia or syncope the use of stimulants is only a waste of time. Artificial respiration must be instituted at once, preceded by the lifting of the chin, according to the method of Heilberg and Esmarch. A tongue retractor may have to be used in some cases and a mouth-gag in severe trismus.

Nélaton considers the syncope as an acute anemia of the brain, and he as well as Marion-Sims advocates a low position of the head. Rhythmical massage of the heart with the thenar eminence of the right hand, rinsing the pharynx with the head hanging, the introduction of a piece of ice into the rectum, transfusions, and inhalation of amyl nitrite are other restorative measures. Heart stimulants, atropin, strychnin, or digalen may be indicated.

Carbolic Acid.—Carbolic acid poisoning produces locally eschars

and necrosis and severe gastrointestinal manifestations, and a series of nervous symptoms, as headache, vertigo, spasms, irritation of the pupils, cyanosis, and collapse. Nephritis usually follows; the urine is dark and gives no precipitate with ammonium chlorid, for the total sulphuric acid of the urine has been fixed as phenyl-sulphuric acid, therefore no longer reacting with barium salts. The treatment consists in lavage of the stomach, administration of calcium and sugar as well as of sulphates which, as above mentioned, combine to form a comparatively harmless compound with the phenol.

Iodoform.—Iodoform intoxication occurs very rarely at present, as we have learned to use this drug properly and apply it usually in the form of iodoform gauze. Iodoform may appear in the urine, but if the kidneys are unable to excrete it it is absent; the pulse is small, vomiting develops, and a symptom-complex resembling meningitis ensues. Melancholia, delusions of persecutions, refusal of nourishment, and in some cases violent delirium may result. The treatment consists in the administration of alkalies, in combating the collapse and the stage of nervous excitement. Chloral hydrate is contraindicated, as the cardiac force is anyway injured.

Alcohol.—Unconsciousness is a constant symptom of acute, severe alcohol intoxication. In some cases the symptoms appear suddenly, producing the picture of apoplexy, but as a rule they develop gradually. After a preceding stage of excitation, consciousness diminishes slowly. Sometimes after a large quantity of alcoholic liquors has been taken, the patient collapses, suddenly becoming unconscious. The conjunctiva and skin are intensely congested, and later cyanosis and dilatation of the pupils follow. A single alcoholic excess may lead to a catarrh of the stomach of long duration, to polyneuritis, and to arthritis. The symptoms of drunkenness are sufficiently known. In children convulsions occur very readily. In adults the state of exaltation is soon followed by sopor, and in some cases coma. The tendency to subnormal temperature is of special importance. Inebriates freeze to death very easily and should be carefully protected against loss of heat. Dilatation of the cutaneous vessels is the cause of this abnormal loss of heat. Alcohol passes into the milk of nursing women, and thus the infants may be affected.

The treatment of alcohol intoxication consists in warm baths with cold showers, cutaneous irritation and sinapism, but, above all, lavage of the stomach, performed as soon as possible. Copious infusions of physiological salt solution and injections of atropin are recommended by others. The manifold sequelæ of alcoholism are well known; it may lead through interstitial nephritis and arteriosclerosis to cerebral hemorrhage, and by chronic inflammation of the kidneys to uremia, epilepsy, and many other nervous disorders.

Delirium Tremens.—An important disorder of consciousness in chronic alcoholism is delirium tremens. It often develops from accumulated excesses in alcohol or from abstinence from it. It may be evoked by inanition, loss of blood, diarrhea, and febrile affections, as pneumonia, and not rarely occurs in persons who have sustained a fracture of a bone. In the majority of cases the delirium appears apparently with no inciting factor. The prodromal symptoms are irritability, restlessness, tremor, and sleeplessness. After a few days, hallucinations develop, the patient thinks himself threatened by animals, first at night and later also during the day, and is oppressed by the anxiety of immediate danger. The condition lasts from three to eight days. Symptoms of motor irritation and an abnormally high temperature may arise, the latter usually a sign of ominous prognosis. The treatment aims, in the first place, to put the patient to sleep without delay. Chloral hydrate should be avoided, owing to the danger of cardiac weakness; paraldehyd and veronal are usually successful. Krafft-Ebing recommends the injection of 0.1 gm. methylal subcutaneously every two to three hours until sleep occurs. Alcohol is only to be given in cardiac weakness, but Kraepelin believes that it is unnecessary even in the most severe cases. Analeptics, cold showers, ether, and camphor will suffice in cardiac weakness. The patient should not be hindered in his activities during the delirium, as the profuse eruption of sweat which may occur under such conditions involves the danger of severe cardiac weakness. However, he must be constantly watched that he may not endanger himself and his environment.

Opium.—Of all vegetable poisons opium and morphin have the greatest importance in toxicology, according to Kobert. In England, for instance, of 527 cases of poisoning observed in two years 37 per cent. were due to opium alone. Children are especially endangered. Of 377 lethal cases 170 were children under one year and 203 children below five years. Most of these cases are due to carelessness, to too large or to too long continued doses, to the custom of some mothers of putting crying children to sleep with a decoction of poppy heads, and to the accidental substitution of opium preparations for other medicaments. Opium is frequently used in suicide, less frequently in murder. In earliest childhood it will be best to avoid the use of opium entirely, as well as of other narcotics. In any case, in the first year of life not more than one-half drop of the tincture of opium should be given *pro die*. Though the effect of opium and of its derivatives will vary according to the quantity taken, sleep and paralysis of the brain functions will be the rule on large doses. A remarkable difference in the effect of opium on the races exists. The Japanese and Malays become temporarily disturbed mentally and are attacked

with a peculiar form of mania. Also in our regions a state of excitation may develop instead of sleep in some persons, especially in women; this may be agreeable, associated with euphoria, but sometimes, may be very unpleasant. Opium may be given per os, per rectum, or in subcutaneous injection, also in the form of inunctions and suppositories. The rapidity and intensity with which the symptoms of intoxication develop depend on the size of the dose. Sometimes it takes half an hour or several hours before the first symptoms arise, consisting in general of fatigue, dizziness, vertigo, and drowsiness; this is followed by deep sleep and complete unconsciousness. The respiration becomes slower and more superficial, sometimes there being only two to five respirations in the minute, until they cease completely. The pulse, too, becomes weak and small, slow and filiform, and scarcely or not at all palpable. The face is pale and puffy, the veins of the neck are swollen, the pupils contracted, but in the later course of the sopor mydriasis develops. The morphin myosis is probably due to a central paralysis of the sympathetic and not to an irritation of the oculomotor nerve. Death occurs from collapse in deep unconsciousness. In children, but also in adults, another picture may be observed, spasms, diarrhea, abundant diuresis, trismus, mydriasis or anisokoria, and itching of the skin.

In regard to the differential diagnosis, apoplexy must be borne in mind. The anamnesis, the characteristic odor of breath and of the vomited matter, the behavior of the pupils, usually dilated and unequal in apoplexy, and, on the other hand, contracted in opium poisoning, will be helpful in diagnosis. An excessive contraction of the pupils may be found in cerebral hemorrhage into the ventricles. Severe inebriation may also be confused; alcoholic odor of the breath and vomited matter is no sure means of differentiation, as suicides often mix the poison in an alcoholic drink; in these cases the peculiar opium odor may be recognized. The pupils are widely dilated in deep inebriation. The antecedents of the case are, of course, of decisive importance for the differentiation. The following fact may also be useful: the drunken man, if awakened, gives stammering answers which are entirely unconnected with questions which have been asked him, whereas the person poisoned with opium answers slowly, but reasonably and in accordance with the question.

For the differentiation of uremic and diabetic coma, the odor of the exhaled air and vomited matter, the examination of the urine, and reaction of the pupils will be valuable. In the first day or two following opium or morphin intoxication, the urine contains morphin, oxydimorphin, albumin, lactic acid, sugar, and other reducing substances. The acute intoxication with morphin gives a picture very similar to the one just described. Also here, medicinal

intoxication furnishes the majority of cases. Morphin is rarely used for murderous intent, as it has a bitter taste; it is used more frequently for suicide. Children, as is well known, are very sensitive to morphin, 0.001 gm. sometimes being fatal. The symptom-complex described under Opium appears here more rapidly. Jaksch observed in a child of one year a few minutes after the internal administration of 0.001 gm. morphin hydrochlorate, loss of consciousness, myosis, and loss of consensual dilatation of the pupils. The effect takes place much more rapidly on subcutaneous application than on internal administration.

The symptoms of morphin intoxication are numbness of the sensorium and coma, contraction and loss of reaction of the pupils, flushing of the face, stertorous retarded respiration, and tachycardia; erythema and outbreak of sweat are sometimes observed in the agonal stage. In fatal cases the coma gradually deepens, and a wet, cold skin, fall of rectal temperature, cyanosis, and retardation of the pulse follow. The latter is due in part to the oversaturation of the blood with carbonic acid which irritates the vagus center in the brain, in part to paralysis of the heart, that is, of the excitomotor apparatus. Very frequently Cheyne-Stokes respiration is seen, especially in organic lesions of the heart, even on comparatively small doses. Twitchings of the lower extremities have sometimes been observed before death.

The prognosis of morphin intoxication depends on the severity of the symptoms and on their rapidity of development; their late appearance may be taken as a favorable symptom, yet there is always the danger of paralysis of the heart.

The diagnosis is assured by the demonstration of the poison in the vomited matter, rinsing liquid from the stomach, urine, or liver.

The treatment of the acute morphin and opium intoxication consists in washing out the stomach, if the condition of the patient permits; this is also indicated on subcutaneous injection of the poison; in artificial respiration, in keeping the patient warm, and in the use of apomorphin in subcutaneous injection, 0.01 gm. in a dose. Oxygen inhalations are sometimes of excellent service. The cardiac weakness is best combated by injections of camphor and strychnin, black coffee may be used as excitant. If coma has once developed, cold showers and the warm bath act very favorably. If all these measures give no improvement the patient should be put into a previously warmed bed, venesection performed, and inhalation of oxygen given. Jaksch has performed tracheotomy in desperate cases and introduced oxygen through the tracheal cannula. In disturbed respiration he advises faradization of the phrenic nerve.

Some authors advocate the use of atropin in morphin poisoning,

while others doubt the effect of this drug. Tannin or permanganate of potassium may be used as antidote, the latter internally, subcutaneously, or as an addition to the fluid of the stomach. If a morphin eater is suddenly obliged to give up the morphin, prostration, precordial anxiety, chilly sensations, and violent diarrhea develop. If the desired drug is not soon given back, severe weakness of the heart and coma, indeed even fatal collapse may develop.

Atropin.—Atropin poisoning leads to dryness and burning in the throat, difficulty in swallowing, extreme dilatation of the pupils, excessive tachycardia, paralysis, coma, and death in a few hours. The skin has a scarlet red color, produced by the enormous dilatation of the capillaries. The treatment consists in lavage of the stomach and in the administration of morphin in large doses, 0.02 to 0.03 gm.

Cocain.—Intoxication with cocain, more common in later years from the use of injections into the spinal canal, leads to paleness and cyanosis of the face, acceleration of respiration and pulse, which soon become irregular, dilatation of the pupils, disturbance of consciousness, and collapse. Lavage of the stomach should be performed at once, and the collapse must be combated by baths and cold showers.

Intoxication from Antipyretics.—A number of antipyretics, as antipyrin, phenacetin, etc., may lead to symptoms of intoxication, in which eruptions of the skin, disorders of consciousness, and collapse are the most important. Here a very pronounced cyanosis is usually present, as well as in the intoxication with nitrobenzol, in which a blue color of the face develops rapidly. Inhalation of oxygen is urgently indicated.

Bacterial Toxins.—A great number of intoxications are due to the metabolic products of bacteria ingested with sausage, meat, fish, or cheese, or with vegetable foods which have deteriorated.

1. Sausage poisoning is due to the fact that bad meat was used in the manufacture of the sausages or that it was not sufficiently smoked. A bacillus develops which produces the so-called ptomatropin. The symptoms consist in severe gastroenteritis, small and frequent pulse, dilated pupils, and extreme dryness of mouth, eyes, and pharynx. Aphonia may develop. The treatment consists in sweating baths, and the subcutaneous injection of pilocarpin hydrochlorate in doses of 0.01 gm.

2. Meat intoxication may be due to a septic infection of the animals during life or to deterioration of the meat after slaughter. We have to deal usually with metabolic products of septic bacteria which cause an intestinal sepsis, often of epidemic occurrence. Calomel and salol are indicated.

3. Certain fish have poisonous glands, other fish eat the toxic jellyfish, and some have become sick. In Japan, for instance, the

poisonous fugu is found, which if eaten leads to severe nervous disorders. The blood of the eel, if not boiled, may have toxic effects.

4. Cheese intoxication is due to tyrotoxin.

5. Pellagra is usually a chronic disease due to intoxication with deteriorated indian corn; it is endemic in Italy and in the United States. All these intoxications may produce very severe morbid conditions in which the consciousness may be disturbed.

Snake Poisoning.—There are over twenty species of poisonous snakes found in the United States, but from our view-point, the number is better placed at four, namely, the coral snake, rattlesnake, copperhead, and the Southern water moccasin. The average mortality of all snake bites is 10 per cent. Snake venom is a mixture of at least two toxalbumins and one globulin; it has the character of the albumoses. The symptoms of snake poisoning are both local and constitutional. There is a rapidly spreading local process of severe degree around the characteristic wound, with markedly hemorrhagic and necrotic tendencies. There is general prostration, the blood pressure falls rapidly, the temperature becomes subnormal, the skin cold and clammy and covered with perspiration, nausea and vomiting are frequent, the power of voluntary motion is more or less completely absent, and the mind more or less clouded; involuntary evacuations of rectum and bladder may occur. All forms of hemorrhages, as epistaxis, bleeding from the mouth, hematemesis, hemoptysis, hematuria, hemoglobinuria, and melena, may be present. Death may occur with dyspnea, spasms, and collapse, and is generally due to paralysis of the respiratory center. The treatment consists in free incision, expression of the poison, and disinfection of the wound. The resorption of the toxin may be retarded by circular bandage of the involved limb. Potassium permanganate and chlorid of calcium, injected into the tissues round the bite, are frequently used. Adrenalin and salt solution will be of value for the constitutional symptoms as long as the treatment with antiserum is impossible for practical reasons. The above remarks are cited from an excellent article by Prentiss Wilson, M. D., "Snake Poisoning in the United States," *Archives of Internal Medicine*, vol.i, No. 5, to which the reader is referred for detailed information.

Uremic Coma.—The forms of disturbed consciousness due to autointoxication are only few, but all are of greatest importance. Uremic coma is due to an intoxication of the blood with urinary substances, due to pathologic changes in the kidneys. From uremia, which is chiefly due to retention of urea, but probably also to that of other excrementitious substances, another autointoxication found in diseases of the uropoietic organs must be strictly distinguished—the ammonemia.

Symptomatology.—The prodromal symptoms of uremia consist in the diminution of the urinary secretions, apathy, headache, and vomiting. Ammonium carbonate can be demonstrated in the vomited matter. Increased tension of the vessels with bradycardia and slight delirium sometimes precede the attack, but in other cases it develops suddenly without prodromes. The temperature in fatal cases increases until death. If the case is favorable, it gradually sinks to normal.

Unconsciousness rarely is the only symptom of the uremic seizure, but as a rule is the last symptom to appear. There first develops a state of drowsiness, followed by convulsions, resembling epileptic spasms, and a comatose condition. The respiration is stertorous and irregular, the pupils dilated and of sluggish reaction, the deep reflexes usually increased. Maniacal manifestations, dementia, transient aphasia, or amaurosis may complicate the attack. These attacks are repeated at irregular intervals, the coma becoming gradually deeper and longer, until death occurs, due to paralysis of the brain, edema of the lungs, or apoplexy. In favorable cases the symptoms of uremia disappear gradually, the attacks become less frequent and lighter, and sopor ceases. The diagnosis is founded on the anamnesis, the urinary findings, the presence of edema, the increased tension of the pulse, and the loud second aortic sound and other symptoms of hypertrophy of the left ventricle, the absence of paralysis, and the history of asthmatic seizures.

Treatment.—In the treatment of uremia derivation to skin and intestines plays the chief part in the prodromal stage, as well as in the attack itself. Diaphoresis is a double-edged sword, for as the blood is poor in water, injurious substances retained in the edematous liquid may, on sweating, pass into the blood. On sweating procedures, therefore, care must be exercised for an abundant water supply (enema). The internal administration of cathartics is rendered difficult by the frequent vomiting. Small quantities of ice-cold liquid and lavage of the stomach will help against the latter symptom. Bromids may be used for the stage of excitation; and by massage of the skin, hot packs, and the subcutaneous injection of pilocarpin we will try to stimulate the sweat secretion. If the patient is vigorous and the pulse full and hard, venesection of 200 to 500 c.c. blood may be a life-saving measure, best accompanied by an abundant infusion of salt solution.

In the uremia of scarlatinal nephritis good results have been obtained from lumbar puncture. The pulse may act very variably in uremia, as it is dependent on two very uncertain components, the cardiac force and the vascular contraction, the latter depending on the toxins; the pulse may sometimes be small and of relatively high

tension. Caffein and camphor injection will be indicated if the cardiac force gives way. If this becomes threatening Leube advises giving an infusion of digitalis, especially if the urinary secretion seems to suffer from the diminished cardiac strength. Analeptics, as coffee, tea, ether, and camphor are then indicated. Hot baths of 40° to 45° C. with cold showers on the neck, sometimes prove successful in combating the coma. Narcotics, chloroform, and morphin should be avoided if possible. If absolutely necessary, morphin may be given combined with camphor. Potain praised the good effect of milk in large quantities, 3 liters a day, in severe uremia.

Eclampsia of Parturition.—The eclampsia of parturition is a condition very nearly related to uremia. Primiparæ are much more frequently affected than multiparæ, the relation being about 3 to 1. With no prodromal symptoms and no aura, consciousness is lost in convulsions. Sometimes consciousness is retained during one of the seizures. Characteristic is the retrograde amnesia, which, as in concussion of the brain, may affect the recollection of important events of the previous day. The urine contains albumin almost constantly and edema exists usually for weeks. The mortality is very high—between 20 and 50 per cent. According to Schauta, multiparæ, according to Olshausen, primiparæ, are more endangered. It is very difficult in a given case to make a prognosis—which is always worse for the child than the mother. A great number of attacks in rapid succession, high temperature, and a small, frequent pulse are unfavorable signs. The treatment must be restricted to diaphoretic measures, by means of packs, the administration of sedatives, as morphin subcutaneously, chloral hydrate in enema, and chloroform anesthesia in bad cases. All obstetricians agree to end the labor as soon as possible. The favorable effect of delivery is clearly seen in about 85 per cent. of cases. Schauta advises delivery under deep anesthesia.

The etiology of eclampsia is still unsettled. First it was regarded as a form of uremia, and all explanations of that condition were applied also to eclampsia. In recent times it has been considered as an independent condition, parallel to the nephritis, and is believed to be of toxic origin. The experiments of Ludwig and Savor showed that the toxicity of the blood serum of eclamptic women is increased, as compared with that of normal pregnant or parturient women, and that the toxicity of the urine, on the other hand, is lowered, pointing to the retention of poisonous substances in the organism, whether there exists an abnormally increased production of leukomains or an insufficient neutralization of toxins due to insufficient action of the liver is not yet decided. The biochemical and cryoscopical methods have in recent times been employed to clear up the etiology of eclampsia, but

the results of these investigations have by no means thrown full light on this question.

Diabetic Coma.—*Theories.*—In a way similar to Bright's disease, comatose conditions appear in the course of diabetes mellitus, for the pathogenesis of which as many theories have been constructed as in uremic coma. Formerly the diabetic coma was regarded as an intoxication with various fatty acids which are derived from the protein molecule, thus also with lactic acid. At present β-oxybutyric acid, diacetic acid, and acetone are regarded as the primary factors in producing the coma. β-oxybutyric acid is considered the mother substance, and diacetic acid and acetone only as its derivatives. In some cases, however, the diacetic acid alone is regarded as the chief cause of coma.

This view is combated by v. Noorden, who emphasizes that acetonuria and diaceturia often exist in diabetes for weeks and months, and then disappear without causing any symptoms of coma, though the patient has become weak in this period of severe acetonuria. The question is more difficult in regard to oxybutyric acid, whose occurrence in large quantities in diabetic individuals is regularly followed by coma, provided the patients do not previously succumb to intercurrent diseases. Noorden follows the view of Klemperer, according to whom, in certain states of diabetes, there develop from unknown causes certain toxic products which, if accumulated, act, first, paralyzingly on the brain (coma) and, secondly, destructively on the protoplasm. If together with this process abundant quantities of oxybutyric acid are formed, then one must ascribe to the diabetic toxins the peculiar property of directing the decomposition of proteins in such a way as to lead to the production of oxybutyric acid, for in other forms of protoplasmic decomposition, as in hunger and fever, oxbutyric acid passes into the urine, but in very small quantities. The formation of oxybutyric acid, the diminution in the alkalescence of the blood, and the coma have therefore not to be regarded as subordinate manifestations, but as coordinate processes. Oxybutyric acid and its derivatives have been found in other conditions, though in much smaller quantities, such as uremia and hysteria, without any symptoms of coma.

Symptomatology.—Frerichs in 400 cases of diabetes observed 151 cases of coma, and divided them into three groups: The first resembles cardiac paralysis, "the diabetic collapse." The second sets in with gastric disorders, excitation, restlessness, anxiety, vomiting, and pain in the epigastrium and head. Sometimes, however, the appearance of coma is sudden, there is dyspnea, the deep labored respiration of Kussmaul, loss of consciousness, sopor, and increased frequency of a small, weak, but regular pulse. The pupillary and tendon reflexes may be normal, spasms are never present, and exitus

occurs in ten to seventy-two hours after the first symptoms. Recovery is exceptional. The third group has symptoms analogous to those of the second, but the dyspnea is absent.

Diagnosis.—The diagnosis is made from the anamnesis and the examination of the urine, which sometimes will have to be taken by catheter for this purpose. The exhaled air has a fruity or chloroform-like odor, as well as the urine which, with ferric chlorid, gives the characteristic Burgundy-red color, and usually contains sugar, though it may be free from it. Peculiar in its nature is the dyspnea, for which no physical cause can be found in the lung. Short, thick, granular casts have been found in the urine of diabetics, disappearing together with the coma. Their outlines are poorly defined, they are pale, broad and short, often apparently broken, and rarely carry white blood-corpuscles or renal elements. Urine which contains numerous coma casts forms a delicate, white, flocculent precipitate on standing, which consists almost exclusively of the coma casts (Aldehoff-Külz). The amount of sodium oxybutyrate, as well as of ammonia, in the urine is very high.

Treatment.—Oxybutyric acid does not originate from the carbohydrates introduced into the body, but from the proteid. Since it develops when organic proteid is attacked in undernutrition, one must, according to Mehring, interrupt the strict carbohydrate-free diet, and give moderate quantities of carbohydrates in the form of milk, bread, and vegetables as soon as an intense ferric chlorid reaction appears in the urine, if headache and loss of appetite appear, or if coma casts are found. Absolute rest in bed is necessary, all excitement must be avoided; 50 gm. levulose are given in lemonade, and every hour a small glass of wine. If the coma has already developed, the treatment is rather difficult. One gives alkalies in large doses for several days, which are really absorbed only if no diarrhea develops. In normal individuals the urine becomes markedly alkaline if a few grams of sodium bicarbonate are given. Naunyn called attention to the fact that on threatening coma, doses many times larger may not affect the acidity of the urine, and he advises therefore the administration of alkalies until the urine quickly changes red litmus-paper to blue. Inhalation of oxygen and sitz-baths at 28° to 30° C., with cold showers, followed by vigorous friction of the skin, may be tried. In some cases the coma develops suddenly, without any apparent inciting factor, in others physical exertion, intercurrent diseases, or severe emotions may lead to its outbreak.

Carcinomatous Coma.—A similar comatose condition is found in patients suffering from carcinoma. The respiration is accelerated here, not retarded as in diabetic coma, the respiratory pause being completely absent. Here also β-oxybutyric acid is present in the

urine, and the alkalinity of the blood is decreased. The threatening coma is announced by the presence of diacetic acid and acetone in the urine, but these are not the toxic substances themselves, but only signs of intoxication. In other cases of carcinomatous coma, they may be absent altogether. Cutaneous hemorrhages and coma have sometimes been observed in still very well-nourished carcinomatous patients who showed no symptoms of cachexia. The prognosis is entirely unfavorable.

Anemic Coma.—The same is true of coma anemicum, which develops sometimes in pernicious anemia.

Diaceturia indicates the pathologic decomposition of the proteins. Especially toward the fatal end, one finds in this disease states of excitation, delirium, or melancholia, which finally lead to coma.

Dyspeptic Coma.—Digestive disorders lead, in exceptional cases, to comatose conditions—the coma dyspepticum. It is sometimes preceded by convulsions, and is distinguished from diabetic coma by the respiration. Large quantities of acetone, diacetic acid, sometimes also of β-oxybutyric acid are present in the urine. The ingestion of deteriorated food, as well as toxins formed within the alimentary canal, may produce this condition.

Cholemic Coma.—In the course of an icterus gravis, coma may sometimes be observed. The differential diagnosis is not usually very difficult, owing to the presence of jaundice. Intoxication with the poisonous biliary acids can scarcely be regarded as the direct pathogenetic factor. The passage of the biliary constituents into the blood is only the causative factor in the formation of the toxin. Cutaneous hemorrhages, states of nervous irritation, furibund delirium, and coma develop here also. Lavage of the stomach and intestines with the simultaneous use of excitants are the most appropriate means in treating the dyspeptic coma. The treatment of cholemia may be found in the chapter on jaundice.

CHAPTER XXII

SLEEPLESSNESS

General Remarks.—Sleep is the periodical cessation in the activity of the cerebral hemispheres, whereby all other nervous functions are also considerably reduced. It is readily understood, therefore, that a too intense activity of the cerebral cortex will be sufficient to render the production of sleep difficult or even impossible, and that all chemical agents which have an exciting action on the cerebral cortex will at the same time cause insomnia. On the other hand, there exist a number of effective substances which may produce sleep. They cannot be regarded as harmless, however, though they may be designated as such by the manufacturer.

Physiological Sleep.—We have above characterized two forms of insomnia, which in opposition to other forms may be designated as physiological, as they occur occasionally in entirely healthy individuals. Excitement, especially sorrow, great expectations, constant thinking, exciting entertainment, cause insomnia by irritation of the psychical centers; stimulating food substances, as coffee, tea, and tobacco, are, too, able to banish sleep.

Habit plays a great part in the pathogenesis of agrypnia. An individual who is used to retiring late will usually be unable to sleep before his usual hour, even though he has seriously decided to break the habit. If the causative factors of insomnia accumulate, sleep may be impaired for a long period. Thus studying at night for examination frequently leads to insomnia, as in the first place sleep is banished by the use of tobacco, tea, alcohol, or coffee, and with this comes the excitement due to the approaching examination.

Significance of Sleeplessness.—The significance of sleeplessness varies according to the primary cause. As a pathologic symptom its seriousness is usually overestimated by persons who are often neurasthenics; however, if it becomes obstinate for a long period, it may affect the patient severely, and lead to a chronic increase of the blood pressure.

Insomnia is often associated with other severe conditions which complicate the prognosis and increase the suffering distressingly. Many cases are associated with severe pain, which is the cause of the insomnia, with paresthesia and itching of the skin, the frequent desire to urinate, and other unpleasant sensations.

Classification of Sleeplessness according to its Mode of Manifestation.—Four kinds of sleeplessness may in general be distinguished:

1. The patient is entirely sleepless the whole night.
2. After a short sleep he wakens and cannot go to sleep again.
3. Sleep ceases in the second half of the night.
4. The patient lies constantly in a half sleep, his self-consciousness being retained, so that he is conscious of lying in bed.

Another disturbance of sleep may here be mentioned which represents, so to say, a typus inversus. The patient turns the night into day; this is, at first, in many cases, due to an irregular mode of life, but it persists later on, though the patient has the serious intention of changing his habits. Especially by infants that cry at night, and sleep during the day, this typus inversus may be produced involuntarily in the mothers and nurses.

Causes of Sleeplessness.—Sleeplessness is often a sequel of other disorders, as dyspnea, cough, cardiac weakness (precordial anxiety), digestive disorders, or pain of various kinds. In these cases the primary cause of the insomnia must be combated, not a hypnotic given at once. The remedies which may have been used during the day should be increased in amount toward the evening, and in headache, neuralgia, etc., pyramidon and antipyrin must not be spared in the evening hours. In cardiac oppression, a cardiac tonic, combined with morphin, given in the evening will give relief.

Some cases of sleeplessness cannot be ascribed to stimuli which reach the cerebral cortex from other organs, but are due to autochthonous irritations. Thus insomnia is found in neurasthenics, in the mentally affected, in senile cerebral atrophy, in progressive paralysis, in delirium tremens, and in all those persons who suffer from fluctionary hyperemia of the brain, as in the reactive inflammation of apoplectic patients following the attack, encephalitis, etc.

In syphilitic, basilar meningitis, continual insomnia is produced not only due to the nocturnal exacerbation of the headache, but even in the absence of any pain. In this disease, the contrary condition may sometimes be present, a sopor, entirely resembling normal sleep, but with this difference, that it is impossible to keep awake, even with the greatest exertion. Against this form of sleeplessness, as well as that of the early stage of syphilis associated with headache, the specific treatment alone will give relief.

Sleeplessness in highly febrile patients, on absence of other complaint, is probably due to the action of the toxins on the cerebral cortex. In tetanus and trichinosis, obstinate sleeplessness develops sometimes without pain or spasms being responsible.

Treatment.—In the treatment of insomnia, the primary cause

should first be removed; and this, of course, may be of so polymorphous a nature that it is infeasible to discuss it in detail.

The treatment of neurasthenic insomnia consists chiefly in hygienic, dietetic, and climatic measures (a sojourn by the sea or in the mountains). Protracted warm baths, of 30° to 35° C. for one-half to one hour, and cold water compresses on the thighs, electric baths, and static electricity, may be found helpful. Care for regular bowel movements is very important in the treatment of nervous agrypnia. One must try to influence the patient psychically, and convince him that he is able to sleep. It is often helpful to leave a soporific, with the advice to use it only if necessary. The consciousness that he can take it when he wishes quiets the patient, and he often sleeps without having made use of it.

Sometimes surprising results may be obtained by a placebo, an indifferent substance of similar taste, being gradually substituted for the soporific thus, for instance, veronal by milk-sugar. In general it is very advisable, if an hypnotic must be given, to change it frequently. The sovereign hypnotic which acts with certainty even in painful affections, but is by no means harmless, is chloral hydrate. In adults it produces sleep in doses of 1 to 3 gm. In children the following doses are advisable:

New-born, 0.05 to 0.2 gm.
One year, 0.1 to 0.3 gm.
One to five years, 0.2 to 0.5 gm.
Five to ten years, 0.5 to 1 gm.

As enema, the double quantity may be given. Delirium tremens responds poorly to chloral hydrate; 4 gm. or more may become necessary. Great caution should be exercised in coexisting pulmonary, cardiac, and vascular diseases, as death may result. The combination of chloral hydrate and antipyrin, of each 1 gm., is much more effective. Chloralose (chloralglucose) and chloralamid are given in the same doses, the latter being permitted also in cardiac and renal diseases. Paraldehyd, 3 to 6 gm. daily, may be given advantageously in cardiac weakness and in old age, but its taste and odor are disagreeable, and the latter may be noticed in the patient's breath the next day. Sulphonal, about 1.5 gm. daily, leaves no unpleasant taste in the mouth, but is contraindicated in renal affections, and has generally been abandoned for its late action.

Of other soporifics, we may mention trional, 1 to 2 gm.; isopral, 0.5 to 1 gm.; dormiol, 0.5 to 2.0 gm.; hedonal, 1.5 to 2.0 gm.; proponal, 0.2 to 0.3 gm.; neuronal, 1.0 to 2.0 gm.; and veronal, 0.5 to 0.75 gm.; also urethan, amylenhydrate, 3 to 4 gm.; and the latest preparations, bromural, methylal, and hypnon. Though some of these drugs may be dispensed with, still it is desirable to have a choice of sopor-

ifics, as patients very easily become inured to one, so that it no longer produces sleep.

One must take into account the subjective sensations of heat and cold from which so many sleepless neurasthenics suffer at night, and give them lighter or heavier bedclothing accordingly.

If there is a tendency to congestion, the trunk should be elevated, and a foot bath of flowing water will be found beneficial in relieving the head by derivation. Too early waking may sometimes be prevented by giving the weak anemic something to eat or drink immediately on going to sleep, or on awakening during the night.

A factor important for the prognosis may still be mentioned. The insomnia in delirium tremens is a proof that hallucinations and other manifestations of the disease still persist. If the patient falls asleep, we may count with all probability on his waking with clear consciousness. Also in febrile disease, a deep sleep often announces a change for the better; thus in croupous pneumonia, where crisis often coincides with the first good sleep since the beginning of the disease.

The total picture which the patient presents should prevent the confusion of restful sleep with physical exhaustion, which often succeeds excitation.

Sleeplessness in Heart Disease.—Of special importance is agrypnia in cardiac diseases, for with insufficient heart sleep is often disturbed, yet the use of certain soporifics for a long period is by no means advisable. Suggestive remedies, as sugar water, or slight hydrotherapeutic procedures, as protracted luke-warm baths, will be sufficient in light cases; exciting reading and mental exertion should be avoided.

Of medicaments, the bromids and veronal may be tried. Chloral hydrate, chloralamid, sulphonal, and trional are contraindicated, as they may lead to collapse. Only in contracted kidney with high blood pressure, the vasodilating, pressure-reducing action of chloral hydrate is not to be dreaded. If narcotics become necessary, they may be combined with camphor to exclude their noxious action on the heart. Such narcotics are dionin, 0.01 to 0.02 gm.; morphin, 0.003 to 0.01 gm.; codein phosphate, 0.01 to 0.03 gm., if coughing spells and dyspnea disturb the night rest; nitroglycerin and sodium nitrate in sleeplessness due to stenocardia.

Sleeplessness in Children.—In children it will scarcely be necessary to use any soporific. One will provide for regular stools, restrict the meat, and interdict absolutely tea, coffee, and alcohol. In urgent cases, 2 gm. of sodium bromid may be given in sugar water. Of the other sporifics, trional in the dose of 0.1 to 0.2 gm. may be employed.

Morphin and its derivatives must absolutely be avoided in the first years of childhood.

CHAPTER XXIII

VERTIGO AND NYSTAGMUS

VERTIGO

General Remarks.—In different ways we receive information concerning the active and passive movements of our own body and its parts; by the sense of vision, along the sensory nerves of skin, musculature, and joints, as well as through the ramifications of the vestibular nerve, *i.e.*, the auditory nerve in the labyrinth. By the function of these nerves, a conception of the position and movements of our body is transmitted to our consciousness, and reflex movements are thus incited, which tend to keep the body in stable equilibrium. If these nerves transmit false information, two conditions will result. (1) A wrong conception of the state of equilibrium and manner of movement of the body will arise in the consciousness. (2) Movements unsuitable for obtaining the desired state of equilibrium will be performed, thus leading to staggering. The combination of these two factors produces dizziness.

According to Hitzig, two different kinds of dizzy sensations may be distinguished, the systematic in which there is a conception of certain pseudomovements, as rotary motion, and the asystematic, in which the idea of position is entirely uncertain.

Physiological Pseudomovements.—If we are subjected to a movement which is not very definitely transmitted by sensory stimulation, as riding on a train or in an elevator, the objects seem to move in the opposite direction, while we have the sensation of standing still. But if we stand on a bridge and look down at the flowing water, we soon have the sensation that the bridge is moving up the stream. In general, it is a rule that we impute the state of rest to objects which occupy a great part of our visual field, rather than to small objects. Thus, for instance, the moon hurries through the clouds, which seem to our visual perception to remain still.

These "pseudomovements" are not connected with the disagreeable subjective sensations of vertigo. But this may occur, though to only a slight degree and transiently, if we follow a movement with the eyes for a time and suddenly direct them to a stationary object. The eyes already accustomed to follow the object by jerks continue this movement, and in this way the resting object moves apparently in the opposite direction.

Vertigo on Rotation.—If we turn or allow ourselves to be turned round any axis of our body, and then interrupt this movement suddenly, our body and the neighboring objects seem to move in the opposite direction. We have the sensation that the floor rises on one side and sinks on the other, and as if we should fall, which we try to hinder by appropriate movements. The phenomenon of vertigo on rotation has been studied thoroughly on human beings and animals by Breuer Mach, Kreidl, and in recent times by Bárány, leading to many interesting results. The nystagmus in man and the movements of the head in animals serve for an objective demonstration of vertigo.

Mach proved by his pendulum experiment that in vertigo on rotation, owing to the action of the centrifugal force, we have lost the judgment as to the vertical position, placing it in the resultant between the force of gravity and the centrifugal force. We feel only the acceleration or retardation, but not the constant, regular movement. The sensation of turning in the opposite direction, which develops when the rotary motion is arrested, ceases when the rotation which led to the vertigo is again resumed.

Galvanic Vertigo.—If a sufficiently strong galvanic current is transmitted through the head, on increasing or lowering the density of the current, the sense of equilibrium becomes disturbed, and pseudo- and staggering movements develop. The patient staggers toward the anode on the closure of the current and on the opening of it, toward the cathode. The subjective turning of the visual field goes in the direction of the hands of the watch if the current streams from left to right, whereas, at the moment of interruption, the contrary movement develops. When the eyes are closed, the pseudomovements of the body exceed those of the object. At the same time, nystagmus develops, consisting in a slow movement of the eyeball toward one side, and a jerking movement toward the other.

Rotation Vertigo, Vertigo at High Altitudes, and Gastric Vertigo in Their Associations.—Every adult has at least once in his life produced vertigo in himself by rotation. From this self-experiment the following recollections have probably remained in the memory (Huguenin):

1. The impression of the rotary movement which led to the sensation of vertigo.

2. The feeling and the auditory sensation of the air moving in the opposite direction to the motion.

3. The idea of the constantly recurring visual impression.

4. The nausea connected with the irritation of the vestibular nerves. These compose the total impression of rotatory vertigo. It may be produced by various optic perceptions, thus from looking down

on the foaming water from a high bridge. Here the vertigo is in the opposite direction to the flow of the stream; looking down from great height may produce vertigo in some persons by purely mental association. It occurs in blind individuals if they believe they are at the margin of a precipice. Children who have no conception of the threatening danger have no vertigo. By irritation of the vestibular nerves, vertigo may lead to nausea and vomiting. Owing to this ultimate association, toxic vomiting may again cause vertigo. Thus morphin in emetic doses leads also to the sensation of vertigo.

General Pathology of Vertigo.—More important than the vertigo occurring under physiological conditions is the pathology of vertigo.

Cerebellar Vertigo.—Cerebellar vertigo consists in the sensation of a turn-table motion, whereby the body rotates round its own longitudinal axis. Nystagmus exists in the direction from which the objects seem to come—sometimes associated with a forced direction of vision toward the same side and an actual turning of the body round the longitudinal axis, opposite to the subjective rotation.

It is pronounced under the following conditions:

1. From the irritation of the ends of the vestibular nerves, which may also be produced physiologically.
2. In diseases of the labyrinth.
3. In diseases of the centers of origin of the vestibular nerves, in the pons.
4. In diseases of the cerebellum, especially in those cases which produce states of irritation, as tumor, abscess, and hemorrhage.

Disturbance of the Static Sense.—If this is the clinical proof of the connection of vertigo with the entire region of the vestibular nerve radiating into the labyrinth, it may be demonstrated by experimental and clinical manifestations of the absence of the functions of the labyrinth.

On Animal Experiment.—Pigeons without labyrinth, whose visual sense is excluded by a cap over the head, show no longer the typical movements of the head on rotation.

In Deaf Mutes.—Kreidl and Pollak obtained similar results in deaf mutes; they showed no manifestations of galvanic or rotatory vertigo, no nystagmus, nor changed conception of the vertical position.

Semiotic Significance of Vertigo.—In a great number of organic diseases of the brain we hear complaints of vertigo, so that this tormenting symptom has evidently a polymorphous, semiotic significance. Especially severe and obstinate is the vertigo in diseases of the cerebellum. In complaints of attacks of vertigo we will have to inquire carefully if consciousness was lost at the same time, or if symptoms of motor irritation were present.

Special Pathology of Vertigo

Brain Tumor.—Attacks of vertigo are frequently complained of in brain tumor. They alternate with epileptiform attacks or precede them and may be combined with headache or vomiting. There are certain differences according to the localization of the tumor. Symptoms of motor irritation and paralysis are often combined with vertigo if the tumor rests near the central gyri. Vertigo is rare, however, in tumor of the temporal lobe. In tumor of the cerebellum, whether in the middle lobe or in the hemispheres, vertigo is the most frequent and tormenting symptom. There exists a certain difference between cerebral and cerebellar vertigo, though we may often be unable to demonstrate it. The first is a symptom of increased intracranial pressure and may therefore be observed in any condition located within the skull which decreases space. It may occur paroxysmally in congestive conditions. Cerebellar vertigo, on the other hand, is a focal symptom which exceeds in violence, obstinacy, and number of attacks the vertigo due to increased pressure. The accessory symptoms, too, are different.

Bradycardia, vomiting, stupefying headache, and even loss of consciousness may be present in increased brain pressure. All these symptoms may be absent in cerebellar vertigo, and if vomiting develops, it may have the same significance as that in the vertigo produced experimentally by the turn-table. Naturally these distinctions may be absent, as increased brain pressure occurs frequently and in a severe degree also in cerebellar tumors. It must be remembered, further, that brain tumor may produce vertigo in another way, namely, by paralysis of the muscles of the eye. This mode of development is chiefly found on localization of the tumor in the corpora quadrigemina and in the pons, as well as in tumors on the base of the brain.

The intensity of the vertigo is also dependent on the position of the body. Only in severe cases, especially in cerebellar tumors, the condition continues even on rest in bed, but it is usually increased on sitting up, and still more on standing and walking.

In regard to the lateral position, it may be said that the patient sometimes feels more comfortable lying on the side of the tumor, sometimes on the opposite side.

Forced Movements in Brain Diseases.—In diseases of the cerebellum true movements may be performed by the patient, who turns to one side or the other, rolls about in bed or assumes a forced position. These symptoms may be observed in affections of the cerebellar hemispheres, of the corpora restiformia, and of the crura cerebelli. The deviations from the straight line, the so-called circus movements, are very characteristic for this condition.

In foci which cause irritation, as tumor or abscess, the turning is from the healthy toward the affected side, whereas in manifestations of lost function occurring after hemorrhage or softening processes it occurs in the opposite direction.

Syphilis of the Brain.—In syphilis of the brain vertigo is a symptom very frequently complained of. Especially in the congestive brain syphilis of Fournier it is found as the first manifestation of the affection, associated with transient disturbances of consciousness and symptoms of motor and sensory irritation. Associated with headache, vertigo is found in the symptom-complex of syphilitic basilar meningitis. Also in specific diseases of the convexity of the brain, in syphilitic meningitis, and in meningoencephalitis, whether circumscribed or diffuse, patients frequently complain of insecurity and staggering on walking and of pronounced vertigo; spastic symptoms and Jacksonian epilepsy may develop and vertigo may be associated with an aura. Attacks of vertigo occur in gumma of the brain, even in those cases where the localization causes no symptoms of motor irritation and paralysis.

Syphilitic affections of the vessels may lead to this condition, especially if the circle of Willis and its branches are involved. According to the position of the head, one or the other part of the brain, important for the maintenance of equilibrium is insufficiently supplied with blood, responding by a disturbed faculty in standing and walking and in the sensation of vertigo. These attacks not rarely announce hemiplegic seizures, whereby often even after a year, through the changes in the vessels, diseases of the internal capsule and of the basal ganglia develop, consisting of hemorrhage or encephalomalacia.

Hemorrhage and Softening; Arteriosclerosis.—Arteriosclerosis, like the specific changes in the cerebral vessels, leads to dizziness from anemia of the brain. This symptom frequently accompanies small hemorrhages or softening in which no other manifestations are present. The presence of vertigo in arteriosclerotic persons will therefore always demand attention, as it points to circulatory disorders in the brain, perhaps even to minute hemorrhages. Such patients should be put to bed with complete physical and mental rest, care for the stools should be provided, and a cold compress applied to the head. In the chronic state of dizziness in these persons the use of derivating, hydropathic procedures and the administration of sodium iodid will give good results. The latter lowers the viscosity of the blood, facilitating in this way a better circulation.

In old hemorrhagic and encephalomalacic foci, vertigo is a frequent symptom, which is to be explained rather by the persistent changes in the vessels than by the old focus, which causes no general irritation. Brain affections due to arteriosclerosis may sometimes involve just

the parts of the brain which are associated with the static organ. This results in violent rotatory vertigo.

Other Brain Affections with Circulatory Disturbances.—Any anemia of the brain leads to vertigo, whether we have to deal with a threatening syncope, due to psychical influences, to cardiac weakness, or to a faulty composition of the blood, or to the accumulation of a large part of the blood in the large vessels of the abdomen. The fact that great terror leads to vertigo is generally known. The vertigo of high altitudes is perhaps due to alterations in the distribution of the blood in the body due to psychical irritation. Nothnagel observed attacks of vertigo in angina pectoris vasomotoria, probably due to cerebral anemia. Hyperemia of the brain leads, too, to dizziness and staggering. Soldiers complain of vertigo and have a staggering gait, reminding one of inebriation before they collapse with the signs of heat stroke. Toxic hyperemia of the brain, due to inhalation of amyl nitrite or to acute alcoholism, is associated with manifestations of vertigo. Inflammations of the meninges and of the brain substance itself, as brain abscess, lead to vertigo. It is frequently observed in cerebellar, but also in cerebral suppurative foci, in some cases occurring very early and with great intensity. The semiotic significance of the symptom is not very great, owing to its polymorphism, especially the appearance of an otogenous abscess formation is not announced by it in an undoubted way, as ear affections *per se* may lead to dizziness. The staggering gait is found not only in cerebellar, but also in cerebral abscesses, as in those of the temporal lobe.

The treatment of vertiginous attacks due to circulatory disorders depends entirely on whether there is anemia or hyperemia of the brain. The observation of the pulse of the carotid artery and of the color of the face will permit a right diagnosis.

Multiple Sclerosis.—In multiple sclerosis vertigo is a very frequent symptom. According to Charcot, three-fourths of all patients complain of this symptom; according to Hitzig, two-thirds. Interesting is the case of Charcot, published in detail by Pitres, of a patient who, except for attacks of vertigo, offered no cerebral symptoms and gave the impression of spastic spinal paralysis. The postmortem examination showed a high degree of sclerosis in the peduncle of the brain and in the spinal cord, whereas the cerebellum was intact. Vertigo may develop at the onset of the disease, but it may be absent during the whole course. Only rarely is it continuous, but the attacks may last for days. Sometimes they resemble the rotary vertigo of cerebellar tumors, in other cases, the attacks of vertigo found in the morbid processes localized in the motor regions. Here they are associated with symptoms of motor irritation or epileptiform attacks. Accord-

ing to the kind of the vertigo, one will suspect the sclerotic plaques to be in the cerebellum or in the motor region.

Vertigo in Epilepsy.—Vertigo may occur in epilepsy as aura, preceding the classical attack. According to Gowers, this occurs in about 1 per cent. of genuine epilepsy.

Abortive attacks of epilepsy, consisting of transient loss of consciousness without convulsions, have been called by some authors the epileptiform attacks of vertigo. Nothnagel protested against this designation which might lead to confusion, and wished the term vertigo epileptica reserved for the epileptic equivalents, associated with the sensation of true vertigo. According to Gower's statistics of 155 cases of petit mal, there were complaints of vertigo in twenty-five cases. It is especially in the lightest cases that patients complain that everything turns round in their head, whereas in severe attacks with complete loss of consciousness and amnesia such complaints are impossible.

There exist in epileptics, long attacks of vertigo, lasting even for days, in which consciousness is of course not troubled, as otherwise the sensation of dizziness could not be perceived.

Vertigo in Neuroses.—*In Graves' Disease.*—In Graves' disease many patients complain of vertigo; only in a small number of these cases have we to deal with a true rotary vertigo, in most cases with an attack of swooning. The sensation of dizziness in paralysis of the eye muscles, which occur rather infrequently in Graves' disease, are not directly dependent on the disease.

Cerebrasthenia.—In neurasthenia cerebralis hysterical pressure on the head and vertigo are frequently found. Krafft-Ebing explains the latter as vasomotor disturbances in the function of the static apparatus. The equilibrium, however, is never completely lost and the patient does not fall, as in Ménière's symptom-complex. Neurasthenic vertigo develops on a sudden change in the direction of vision or the position of the head, thus on sudden bending down or in the morning on leaving the bed. In apparently healthy individuals after intense mental work, vertigo may be seen as the only mental symptom. This must probably be considered as a sign of cerebrasthenia, as well as the generally known frequent inability of some people to endure traveling by train without nausea if sitting backward.

Hysteria.—Hysterical individuals complain often of vertigo. On closer analysis it may be found that patients have falsely called syncopal attacks without loss of consciousness vertigo. Darkening of the visual field and scotoma with scintillating edges are usually present. Attacks sometimes develop which may be designated as a pseudo-Ménière's disease. Females have such a horror of these attacks

of vertigo that they lie in bed for years, carefully avoiding every movement.

Hypochondria.—Complaints of dizziness which may even lead to astasia and abasia occur frequently in hypochondriacal patients. There is present an abnormal irritability which transmits physiological irritation of the static organ in a magnified degree to the consciousness.

Traumatic Neurosis.—In traumatic neurosis, especially after traumatism to the head, vertigo may develop, even in absence of all concussion of the brain. True rotary vertigo is, however, present only in few of these cases; mostly in those associated with fracture of the base of the skull. The hearing power is then decreased, the osseous constituents of the internal ear are injured, and suppurative processes may be present. There then probably exists the true Ménière symptom-complex, as all the other concomitant symptoms are more or less demonstrable.

Patients who have suffered from an accident sometimes complain of dizziness on bending down or working with bent body, giving this symptom as the main hindrance to their ability to work. Objectively, one may find in these cases that in the indicated position symptoms of cerebral congestion develop. However, according to Oppenheim, one must guard against simulation, observing carefully whether the patient does not perhaps produce these symptoms by a voluntary arrest of respiration.

Migraine.—The aura in migraine only rarely consists of sensations of dizziness, but in those cases which are associated with flittering scotoma patients often complain of vertigo.

Diplopia which, too, may lead to giddiness is exceedingly rare in migraine.

Ménière's Vertigo.—*Symptomatology.*—Ménière's vertigo occurs in acute and chronic diseases of the middle ear and labyrinth, possibly also in affections of the auditory nerve, the vestibular nerve and all its central ramifications. The patients have the sensation that the floor reels under their feet and have a true rotary vertigo. Some state that the rotary motion of objects is always in the same direction, and that in the unilateral affection it may be clockwise or counter-clockwise. Patients sometimes have sensations similar to seasickness. Not seldom they collapse suddenly with loss of consciousness.

The triad, tinnitus, vertigo, and nausea, may follow a trauma, which in the form of an apoplectic insult may cause chronic deafness, or the symptom-complex may be added to an ear affection already existing or to manifestations of a chronic nervous disease, brain tumor, brain abscess, tabes, or abortive cerebrospinal meningitis.

Similar symptoms are found in genuine intoxication and as pseudo-Ménière attacks in hysteria, neurasthenia, and traumatic neurosis.

Diagnosis.—In typical cases the diagnosis of Ménière's disease is easy. However, one should not be satisfied with the recognition of the symptom-complex, but should become enlightened as to the causal disease. Leukemia, syphilis, tabes, progressive paralysis, etc., may appear as etiological factors.

Prognosis.—Naturally the prognosis *quo ad vitam* depends on the primary condition. As far as the hearing power and relief from attacks are concerned, the outlook is rather dark. The vertigo can usually be improved, but the deafness usually increases until the last remnant of the hearing power is destroyed by the repeated attacks.

In traumatic forms with fracture of the base of the skull we will have to fear a meningeal infection in the first days. Ménière's symptoms, developing in the course of ear affections, are dependent, as far as their prognosis is concerned, on the ear affection. If it is an acute suppurative inflammation of the middle ear, complete recovery is possible; if, however, it is an otosclerosis, great success cannot be hoped for from the therapy.

The parallelism between the vertigo and the hearing power is not complete; the latter may further decrease, while the symptoms of Ménière may recede. On the other hand, a relapse of vertigo may appear without any recognizable cause.

Treatment.—The apoplectic form of the disease is treated with the same measures as cerebral hemorrhage—rest, derivation to the intestines, an ice-bag, and cupping-glasses on the mastoid process. Treatment of the ear by a specialist is of course indicated in all cases of Ménière's symptom-complex which complicate ear affections. In cases due to syphilis, the specific treatment must be energetically applied. A number of medicaments have been recommended, of which quinin sulphate, recommended by Charcot, is in highest favor. It has to be given for weeks in doses of 0.5 to 1 gm. It increases the dizziness and tinnitus at first, but the discomfort ceases after a time, though the hearing faculty is hopelessly lost and it is not easy to decide whether this deafness is the result of the progressive process or of this medication. To clear up this question it may be mentioned that the transition into complete persistent deafness often goes hand-in-hand with a decrease in Ménière's symptoms. One will, therefore, be skeptical in believing in the healing effect of quinin, as well as its harmful influence on the sense of hearing. At any rate, we shall have to tell the patient of the possibility of loss of hearing before commencing Charcot's quinin treatment. We may try to find the probable outcome with small doses of quinin, about 0.05 to 0.1 gm.

Besides quinin, bromids, especially in combination with sodium iodid, tincture of nux vomica, up to 10 drops a day, salol, in doses of 1 to 2 gm. per day, and injections of pilocarpin hydrochlorate have been recommended from various sides.

Politzer injects 2 to 8 drops of a 2 per cent. solution of pilocarpin; Gradenigo, on injecting a 1 per cent. solution, increases from 2 to 6 parts of a Pravaz syringe gradually upward, until the pilocarpin effect, consisting in sweating and salivation, develops.

Of undoubtedly good result is in some cases the lumbar puncture. Vertigo, nausea, and tinnitus cease a few hours after it, and Babinsky has even related cases where the attacks did not reappear after this intervention. Some writers warn against the use of electricity; others recommend it if employed with great care. The knobbed electrodes are applied on the two mastoid processes, and the current is increased very gradually to about 1 MA. and decreased in the same way after two to five minutes. The treatment is first given every day, later on twice a week. Static electricity on the head has sometimes proved effective (v. Frankl Hochwart).

Other Forms of Vertigo Due to Ear Lesions.—Attacks of vertigo originating in the ear may be produced in various ways; for instance, by auditory irritation with tones of very high pitch, by syringing out the ears with water which has not the proper temperature or which is injected under too high pressure. Sometimes special anatomical changes may be the true cause, as an open fenestra ovalis. Paracentesis of the ear-drum, catheterization of the Eustachian tubes, and other interventions in the ear may be associated with a more or less rapidly passing vertigo of varying intensity. Sometimes attacks of vertigo exist with perforation of the ear-drum, ceasing at once if the opening is closed by ear wax or an artificial ear-drum. This is probably due to the injurious influence of the atmosphere. Not only by affections of the internal ear and the tympanic cavity is vertigo incited, but also by those of the Eustachian tubes and auditory canal.

Tabes Dorsalis.—*Syringomyelia.*—True labyrinthian vertigo occurs in tabes dorsalis; difficulty in hearing and even deafness may exist, with the subjective sensation of sounds and with various anomalies in the function of hearing discovered by exact examination. Romberg's phenomenon and ataxia have no connection with the vertigo, though they may be considered as related by the patient. Both symptoms, as well as the atactic gait, are due to cerebellar affections. Bulbar forms may occur also in syringomyelia.

Vertigo in Intoxications and in Toxic Affections. — *Medicinal Poisons.*—In various intoxications vertigo develops, but it is more a sensation of giddiness; the patient complains of losing the floor out from under him. This symptom is found especially in quinin poison-

ing, sometimes even after doses which are entirely proper. We have here probably to deal with cerebral anemia, which may be surmised from the aspect of the eye-grounds. Alcohol, tobacco, and the salicylate preparations may act in a similar way.

Diabetes Mellitus.—The vertigo of diabetic patients also is a toxic one; they suffer occasionally from headache and such severe dizziness that they have to hold on to something to keep from falling. This symptom may be present, though the excretion of sugar is not very high and no acidosis exists. Yet in some cases it is possible to remove the vertigo by rendering the patient free from sugar, but in other cases this is of no influence.

Gout.—One sometimes hears complaints of vertigo lasting for months or even years, until finally the diagnosis is cleared up by a typical attack of gout. Arteriosclerosis with circulatory disorders in the brain is frequently the pathogenic factor; in other cases, intestinal autointoxication.

Acute Infectious Diseases.—In convalescence from acute infectious diseases attacks of vertigo may develop due to cardiac weakness and anemia; they occur, therefore, very readily if the patient leaves the bed too early. During the prodromal stage and the outbreak of a severe infectious disease many patients complain of dizziness, which then is probably due to the effect of the bacterial toxins.

Vertigo from Stomach Lesions.—The fact that there exists a gastrogenous vertigo was known even to the old physicians, as Boerhave. Later Trousseau studied this *vertigo e stomacho læso*, reporting cases who even fell down in this rotary dizziness. The most varied affections of the stomach, as chronic anomalies of secretion and disturbance of motility, as well as hyponutrition and anemia due to intestinal affections, are considered as the inciting factors. Vertigo occurs also in intestinal parasites, especially tenia.

That autointoxication is frequently the primary condition in this vertigo seems probable from its development in certain idiosyncrasies. Some patients are attacked by vertigo on eating certain foods, as eggs or fish, just as others are affected with urticaria after eating crabs or strawberries. The conception that the vertigo is due to the gastric affection is proved by the treatment. It disappears if the gastric atony or anomaly of secretion disappears. In making the diagnosis of gastric vertigo one must take care not to overlook a brain tumor, as vertigo and vomiting are the most frequent symptoms in this condition.

Reflex Vertigo.—From the gastrointestinal canal vertigo may be incited by reflex; thus Leube observed attacks of giddiness on digital examination of the rectum. Also strictures of the urethra and cryptorchism have been blamed as inciting factors. Whether there

exists a nasal, pharyngeal, or laryngeal vertigo is not yet decided. In many cases of so-called ictus laryngis, we may have to deal with epileptiform conditions or the laryngeal crises of tabes. On endolaryngeal galvanization one may observe attacks of vertigo, but they may be explained by the communicating loops of the current which involve the vestibular nerve. Compression of the carotid artery may in some cases produce this symptom.

Vertigo from Eye Lesions.—Very important is the ocular vertigo which is produced by faulty localization, diplopia, and paralysis of the eye muscles. If the patient looks in the direction which most involves the function of the paralyzed muscle, the symptom becomes very marked. In inveterate paralysis the diplopia and dizziness cease, because the patient has learned to disregard the perceptions of the paralyzed eye. The vertigo can be caused to disappear at once by the application of a bandage to the affected eye. Sometimes the patient learns to eliminate the action of the paralyzed muscle by an oblique position of the head. Operations for strabismus may be followed for some time by vertigo.

Seasickness.—Also, seasickness belongs here. It is produced by the rocking movement of the ship if it turns on its three axes from the irregular force of the waves. The sensation of the downward movement of the middle portion of the ship may incite nausea and vomiting almost simultaneously. An uncertain sensation of discomfort, characterized by a peculiar loss of will, is followed by nausea with chronic loss of appetite and vertigo. The latter is by no means the primary symptom of seasickness, but like the other symptoms is dependent on the primary condition. The cardiac activity is disturbed at the same time, as is frequently the case in nausea. As vomiting decreases the discomfort, at least for a short time, it will be advisable for the patients not to abstain from food entirely, as most of them prefer to do during seasickness. Seasickness is healed the moment the patient steps on firm land; its importance therefore need not be highly estimated. One must take care, however, at sea, not to call every similar attack seasickness and must not forget that other conditions, as uremia and cholera, may produce a similar picture. Prophylactically, it will be advisable to avoid excesses in eating and drinking, but, at the same time, not to go on shipboard with an empty stomach, to be in the fresh air as much as possible, and to support the abdominal organs by a tight bandage. On a short stormy passage 0.01 to 0.03 gm. cocain hydrochlorate often acts excellently, usually preventing the nausea and vomiting. Opium and morphin may also be of good service for a few hours after the disease has developed. Beard recommends large doses of bromids, 2 to 4 gm. twice a day, for two or three days immediately before sailing. English and American

physicians have advocated the inhalation of amyl nitrite, 3 drops on a handkerchief.

General Treatment of Vertigo

The manifold origin of vertigo renders a uniform treatment of the symptom infeasible. Thus in arteriosclerotic vertigo we may give sodium iodid with powdered digitalis leaves in pills, whereas in other cases the amelioration of digestive disorders or the treatment of an ear affection will bring about relief. In all forms of vertigo the galvanic treatment may be tried cautiously; this is emphasized by the existence of a galvanic vertigo. If a galvanic stream is passed transversally through the head, the normal individual has the sensation of falling toward the side of the anode. One will therefore choose the direction of the current in such a way that the cathode is applied on that side toward which the patient seems to fall. One must creep in and out with the current very carefully, as a sudden interruption of the stream again produces vertigo. In the beginning the treatment should last only two minutes. Faradization, galvanization of the sympathetic nerve, and static electricity may also be tried. In intimate connection with affections of the static sense is nystagmus, with its relation to the vestibular apparatus.

NYSTAGMUS

General Remarks.—Small rhythmical excursions of the eyeballs, in the transverse or vertical direction or in the form of rotary movements, is called nystagmus. The movements may be equally rapid toward both sides (undulation), or it may be rapid and jerking, with a slow return.

Occurrence.—Nystagmus occurs in healthy individuals if they look in the maximal lateral direction; others have learned to produce it voluntarily. In all other cases nystagmus is a symptom of pathological significance, though it may arise under very different conditions.

Nystagmus in Visual Defects.—Thus it is found in all congenital visual defects of the eye, also in affections which, at an early age, have lowered the visual power, as blennorrhea neonatorum. We usually succeed in distinguishing this form from the nystagmus due to changes in the vestibular apparatus, for the aural nystagmus is never associated with pendular movements of the head or blepharospasm; it is never vertical and is not, like the visual nystagmus, changed by covering one eye.

Nystagmus in miners has the characteristics of visual nystagmus. It is due to the extreme upward direction of the eyes on working and to the bad light in the mines. The nodding spasm of small children

is probably caused by the same factors. The small children of the poorer classes lie in dark rooms, and stare constantly toward the ceiling, the window, or a glittering metal object. In this way peculiar nodding of the head develops, which at the height of the condition is usually associated with nystagmus. If patients suffering from paresis of the eye muscles try to look in the direction which corresponds with the function of the paralyzed muscle, nystagmus usually develops. Horizontal nystagmus of slight degree is especially frequent in functional neuroses. Pronounced jerking combined with vertigo and pseudomovements are of more important semiotic significance, especially if they develop on looking toward one side, on certain positions of the head, and in attacks.

Nystagmus in Diseases of the Central Nervous System.—In such cases an involvement of the vestibular nerve may be surmised. The labyrinthine nystagmus consists constantly in jerking movements in one direction and never in undulating movements. This form is found in tabes, owing to a diseased condition of the internal ear. Nystagmus in Friedrich's hereditary ataxia does not correspond entirely with the vestibular type. The latter is of great importance for the diagnosis of multiple sclerosis, where it is in evident connection with the rotary vertigo of which the patient complains. Rhythmical nystagmus is, further, a very frequent symptom in affections of the cerebellum. Oppenheim is inclined even to consider it a focal symptom. Barany states that in affections of the labyrinth the oscillatory movements occur in the direction of the healthy side, in affections of the cerebellum toward the affected side.

Reflex Nystagmus.—Typical aural nystagmus may be found associated with various forms of vertigo, whether due to cerebral anemia or to digestive or toxic influences, or in Ménière's disease.

Vestibular Nystagmus.—By passive rotation, galvanization of the head, and syringing out the ear with water differing greatly from the body in temperature, pseudomovements and vertigo, as well as objectively visible nystagmus, may be produced.

In animals, but not in human beings, nystagmus of the head may be produced by rotation. The sensation of pseudorotation of the body is absent if the eyes are closed, which points to the fact that stimulation of the static organ is perceived in the consciousness only by the simultaneous production of nystagmus. If the rotation is interrupted, postnystagmus in the opposite direction appears.

On complaints of rotary vertigo, we will expect to find vestibular nystagmus constantly, but, on the other hand, it may exist with out any pseudomovements.

If a unilateral destruction of the semicircular canals exists no nystagmus is produced by syringing out the ear involved and gal-

vanization. On rotation, a typical change of the normal action may be observed, characteristic for the unilateral destruction. If the vestibular apparatus is disturbed on both sides, nystagmus is obtained neither on rotation, syringing, nor galvanization. To recognize this insufficiency of the semicircular canals and to diagnose suppuration of the labyrinth is of greatest practical significance, especially in operative cases (Bárány).

Vertigo and nystagmus occur also in fracture of the base of the skull, with involvement of the internal ear. Immediately after traumatic injury of the labyrinth, a pronounced nystagmus develops which lasts several days, and then rapidly decreases, but may be demonstrated in traces even after weeks. The healthy labyrinth or static center is at the same time in a state of irritability.

Since Bárány observed an undoubted nystagmus on differences of 1° C. between the temperature of the syringing fluid and that of the body, the exact temperature of the water used in injections into the tympanic cavity is strictly indicated.

CHAPTER XXIV

DISORDERS OF THE BLADDER

(*Disturbances in Micturition*)

General Review.—Symptoms of great diagnostic importance on the part of the bladder may arise from manifold causes; from disease of the bladder itself, and of other organs which stand in functional or topical relation with it, and from disturbances in the innervation of the bladder. These manifestations point in many cases to severe pathological processes, and for this reason demand attention on the part of the physician, as well as for the fact that they are felt as very unpleasant or even tormenting by the patient; they may even involve danger to life.

Disorders in Organic Affections of the Bladder and in Other Diseases of Abdominal Organs.—Intimate correlation exists between bladder symptoms and diseases of the abdominal organs. Thus urinary retention is occasionally observed in appendicitis, in rectal diseases, and in affections of the female genital tract. Pain in the kidney and in the renal pelvis are often attributed by the patient to the bladder, and, on the other hand, vesical affections may lead to the sensation of pain in the kidney region (tenesmus renalis).

Zuckerkandl points out that the coinvolvement of the bladder in diseases of the kidney may be ascribed to three factors. In the first place the affection of the kidney may have extended by continuity through the ureter toward the bladder. In the second place the bladder symptoms are produced reflexly; and, thirdly, the pathologically changed urine may act irritatingly on the mucosa of the bladder.

Reflex Retention of Urine.—The best example of a reflex affection of the bladder is the urinary retention following operations on the kidney. Renal colic is often preceded by slight disturbances of urination. The desire to urinate is more frequent than normal, and is felt more disagreeably by the patient. In some cases a marked pain occurs, especially at the end of micturition. These symptoms usually outlast for some time the renal colic, and only after they have ceased completely can the attack be considered entirely passed. In many cases there is probably not merely a pure, reflex involvement of the bladder, but small concrements may actually have passed through the deferent urinary passages.

Reflex Tenesmus of the Bladder.—This tenesmus of the bladder is

only rarely found in nephritis and in calculi located in the renal pelvis; more frequently in tuberculosis of the kidneys, where cramp-like pains are sometimes referred to the bladder, even though there is no specific involvement of the bladder. In cystitis and posterior urethritis the tenesmus of the bladder may reach the most severe degree, and it may become very tormenting in suppurative processes of the prostate and in stricture of the urethra. Renal hemorrhages, too, may lead to a severe tenesmus if the blood, reaching the urinary bladder, coagulates there into a large clot. In parametritic exudates, ovarian abscess, appendicitis, and severe inflammatory affections of the rectum, complaints of vesical tenesmus may be heard; the cystoscopic examination in these cases often shows involvement of the bladder.

Inflammatory infiltrations, neoplasms, and extensive loss of substance in the bladder wall may restrict the elasticity of the organ to such an extent that they frequently produce painful urination, which may also be produced if the bladder cannot dilate sufficiently, owing to abnormal position or pressure from the neighboring organs. Patients with calculi in the bladder suffer especially from stranguria, if they move about, whereas they may sleep the whole night through without urinating.

In opposition to this form of stranguria, subjects of an enlarged prostate suffer at night from frequent micturition. On cystoscopic examination, the mucosa is found inflamed round the internal orifice and this congestion is increased still more from the warmth of the bed. Thus these patients may suddenly have the desire to urinate if they sit for a long time on a soft chair. That congestion of the urinary bladder may lead to stranguria is seen occasionally during menstruation and in pregnancy where, with no other severe symptoms on the part of the bladder, frequent urination may be present. The desire to urinate is further increased by obstinate constipation or hot baths.

Bladder Pain.—The bladder is often the seat of severe pain, independent of frequent urination, especially in carcinoma of the bladder, where, on absolute rest, severe pain may be present which radiates into the rectum. An abnormal composition of the urine may render the emptying of the bladder painful, as the febrile urine of high specific gravity and the urine rich in phosphates, which cause pain on passing through the normal urethra. The most frequent cause of painful urination is urethral gonorrhea. The pain in the region of the bladder is occasionally increased on defecation, especially if the prostate is diseased.

Nervous diseases of the bladder may lead to violent pain. Only if organic affections of the bladder, rectum, pelvic organs or kidneys can be excluded, may a purely nervous condition be diagnosed.

Especially in tabes, one will do well to be careful in pronouncing urinary troubles too hastily as functional ones, for in tabes, as well as in progressive paralysis and syphilitic meningitis, organic affections of the cauda equina occasionally occur.

Difficulty on Emptying the Bladder.—Difficulty on emptying the bladder is found occasionally in healthy persons if the bladder has been overdistended by a far too long voluntary suppression of micturition. Thus Nothnagel in his lessons told of a cavalry soldier who was obliged to sit for hours in the saddle with an overfilled bladder, and who was then unable to pass the urine.

Dysuria.—By dysuria is understood difficulty and painful micturition, whereby the auxiliary muscles, as the abdominal and perineal, must assist in the evacuation. Dysuria occurs in strictures and in diseases of the prostate gland and if a stone or pedunculated tumor obstructs the internal orifice of the urethra.

Retardation.—Dysuria sometimes takes the form of retardation; the patients are not able to urinate when they wish. There exists a physiological form of retardation which develops if one wishes to urinate at a time when the bladder is still rather empty, as, for instance, if one wishes to perform this function before it becomes actually necessary, as before leaving the house. It is also found in diseases of the posterior urethra, prostate, and bladder.

Changes in the Form of the Jet of Urine.—Changes in the form of the jet of urine occur frequently in the partial closure of the external orifice, due to secretion in chronic gonorrhea. The jet may occasionally become as thin as a thread, which, of course, is only of importance if the external orifice is of normal dimensions. The change in the jet on a normal size of the external orifice may be due to a deep-seated stenosis or to insufficient action of the detrusor muscle on absence of stenosis.

Patients who have suffered long from gonorrhea and tend to hypochondriacal fears in regard to the state of their urogenital organs, come constantly with complaints of the change in the form of the urinary jet. If the remains of a chronic gonorrhea is present, it must be carefully treated, but otherwise we must convince the patient of his healthy condition to restore his self-confidence.

Small Projections in the Jet of Urine.—A noteworthy symptom is the small projection of the urinary jet. It is found in neurasthenics, due to a paresis of the detrusor muscle; in senile hypertrophy of the prostate and in strictures. In the latter cases the projection always depends on the compensation. Young, vigorous individuals, even with a high degree of stenosis have a normal projection, namely, if the bladder musculature hypertrophies sufficiently in accordance with the obstacle. The projection always diminishes if this hyper-

trophy fails, especially in stricture and hypertrophy of the prostate, and finally in spinal paralysis of the bladder.

Disturbances of Evacuation of the Bladder.—The evacuation of the urine may sometimes be disturbed in its continuity, as in all forms of dysuria, if the auxiliary muscles assisting in micturition suffer some interruption in their action; also in mechanical dysuria, where there are no signs of auxiliary participation of the abdominal and perineal musculature. This interruption of continuity will be found if the musculature of the bladder has undergone senile atrophy or been stretched by overdilatation or inflammatory processes, and finally in nervous affections. Sometimes the patient observes that the act of urination is suddenly interrupted. In this case one will think of a sudden obturation of the internal orifice by a stone or a pedunculated tumor, as villous cancer. In the spastic form of dysuria, the evacuation of the bladder is sometimes performed in single, forceful jets.

Change in Frequency of Urination.—As far as the frequency of urination is concerned, an interval of four hours is normal for the healthy man during the day. Women, as is known, have gained the faculty of urinating less frequently—due for the most part probably to social considerations. Children urinate normally more frequently than adults.

Two forms of increased frequency of micturition may be distinguished. In the first case we have to deal with an excitable bladder which always necessitates urination at short intervals. In the second case, the anomaly is less continuous, and the repeated desire to urinate occurs rather by attacks.

The factors which lead to frequent urination have been enumerated above. Here we only wish to emphasize that there is a nervous pollakuria which appears if the patient has some important business which will prevent him from urinating in the succeeding hours; as the nervous pollakuria in stage-fright. Spinal disease may occasionally lead to it, though it is well to bear in mind the distinction between polyuria and pollakuria; it will be found that many subjects of polyuria urinate very frequently also, which, however, is not the case in polyuria with diseased sensibility of the bladder.

Precipitate micturition is that anomaly of urination where, at once, after the first warning, the urine appears, or as the urologists express it, the desire to urinate is imperative. This is found especially in states of congestion of the bladder and posterior urethra, and in hypertonic bladder.

Decreased Impulse to Urinate.—A decreased impulse to urinate is chiefly found in nervous people and in children. It is readily understood that this decrease will always be present if the sensorium is

dulled, or if, owing to the inferior mentality of the patient and his failing sense for cleanliness, he pays no attention to this desire. The impulse to urinate will also be absent if the quantity of urine is greatly decreased, as in acute febrile diseases, where the patient produces only very little urine, and may not pass it once in twenty-four hours. There are great individual differences in regard to the frequency of micturition. There are persons who habitually urinate only two to three times a day. However, it must be considered pathological, if, as is sometimes stated, persons pass urine if they happen to think about it. In other cases decreased micturition shows itself in this way, that a residual urine is still to be found in the bladder after the patient supposes it to be entirely empty. On decreased sensibility of the bladder we must always inquire whether the patient perceives the passage of the urine through the urethra or not. Local affections leading to this condition are inveterate hypertrophy of the prostate and changes in which the filling-up of the bladder is impossible, as in vesicovaginal fistula. In nervous diseases, as tabes and other spinal affections, in progressive paralysis and in hysteria, the same symptom may be found. In spinal affections, paresis of the detrusor and incontinence are often associated with a decreased sensibility of the bladder.

Nervous Dysuria.—In those cases of dysuria where the examination of the urinary apparatus shows no anatomical obstacle, as stricture, neoplasm, calculi, enlarged prostate or hemorrhoids, the rectum and the female genitalia should be carefully examined, as occasionally cancer of the uterus or pregnancy may lead to dysuria.

Since the bladder is frequently anesthetic in spinal diseases; a local anatomical basis for the dysuria is frequently overlooked. Purely nervous dysuria is found in spinal affections, more rarely in cerebral affections, and exceptionally in multiple neuritis. Intoxication with carbon monoxide or oil of turpentine may lead to difficult and painful urination. Dysuria may lead to retardation of the urinary jet, and in this way to partial or complete retention. This may be due to spasm of the sphincter muscle or to paresis of the detrusor. Spasm of the sphincter is occasionally found in transverse lesions of the spinal cord, in multiple sclerosis, in apoplexy and concussion of the brain. Paresis of the detrusor occurs in soporous and idiotic patients, thus in benumbed sensorium during the apoplectic attack in progressive paralysis, tumor and abscess of the brain, severe intoxications and infections, uremic and diabetic coma, and after cerebral trauma.

On certain localization of cerebral affections, the dysuria may govern the picture, thus in affections of the corpus striatum and in certain spinal diseases, in diseases of the meninges, progressive paralysis, multiple sclerosis, and cerebrospinal syphilis. In sensile

dementia, not necessarily advanced, and in typhoid fever with entirely clear sensorium, paralysis of the bladder may be observed.

There are diseases in which dysuria may be produced by paresis of the detrusor, without involvement of the sensorium. Here belong tabes, transverse myelitis, multiple sclerosis, syringomyelia, diabetes insipidus, and dilatation of the bladder. Exceptionally paresis of the detrusor may be observed in postdiphtheric paralysis, and then usually associated with disorders of urination and defecation.

Retention of the Urine.—Occurrence.—All grades of transition exist between dysuria and urinary retention. This latter may be complete or incomplete; if the latter, a considerable quantity of residual urine is found after each evacuation; it may develop as an acute or chronic mechanical process. There are mechanical hindrances which may lead to urinary retention, stricture, foreign body, tumors, and calculi; the small stones especially may cause obstruction of the internal orifice, while the larger ones do not usually lead to this condition, as they are not as readily movable. A blood clot formed in the bladder after urinary hemorrhage may produce retention of urine, as well as the compression of an enlarged prostate, whether the enlargement is due to inflammation, simple hypertrophy, or neoplasm. Lesions and stricture of the urethra, of gonorrheic as well as of traumatic nature, all inflammatory processes of the urethra as well as its compression by the neighboring tissues, whether tumors or fractures or tampons in the vagina or rectum, may cause urinary retention. In other cases the urethra is displaced, either congenitally or by morbid processes; stenosis of the urethra and even complete obliteration of the internal orifice, in its normal position, as well as in hypo- and epispadia, also a high degree of phimosis, are all conditions leading to retention.

Since even the fetus secretes urine, these congenital conditions may lead not only to an excessive dilatation of the bladder, but also to dilatation of the ureters and the renal pelvis; and, indeed, the whole renal parenchyma may be destroyed by hydronephrotic degeneration. If a new-born child does not urinate, we must think of congenital cystic kidney and hypoplasia and aplasia of the kidneys. These children are, of course, not able to live. Aplasia of one kidney is usually of no significance as the other kidney hypertrophies vicariously. In such cases a horseshoe kidney may sometimes exist, a condition usually diagnosed only postmortem.

Obliteration, stenosis, and kinking of the ureter will lead to hydronephrosis of the corresponding kidney, but if the other kidney is well developed it involves no immediate danger to life.

In old age, urinary retention is due to senile degeneration of the bladder musculature. In the course of an appendicitis, in genital and

rectal affections, and following laparotomy it may develop as a reflex condition.

Acute, incomplete retention leads reflexly to polyuria. If the retention is of long standing, the renal function will be injured. Guyon observed, after urinary retention of sixty hours, degenerative processes in the kidney; on short duration these may still be corrected, on long duration they will lead to a chronic condition.

Symptoms of Acute Retention.—In acute retention of urine we find a palpable tumor, sensitive to pressure, which may be felt over the symphysis and through the rectum. This corresponds to the bladder. In this way retention differs from anuria, where, too, urination is absent, but nothing points to a full bladder. Urinary retention is usually associated with considerable pain, except in spinal affections, where anesthesia of the bladder is so frequent that the urinary retention can only be diagnosed on proper examination.

In urinary retention we will think first of the prostate and of spinal affections. In old people, hypertrophy of the prostate is the most frequent condition, in the young the acute inflammations of the gland. In the years of middle life, stricture of the urethra is the most frequent condition. The anamnesis in hypertrophy of the prostate shows complaints for a long time of nocturnal discomfort of the bladder, whereas in stricture the discomfort showed no variations, but increased constantly and gradually.

Dribbling of Urine.—In nervous conditions it is usually said that the patients do not feel the dribbling of the urine. This symptom is very frequent in severe urinary retention, and is the natural protection against rupture of the bladder. Nevertheless this condition may occur in deep-reaching ulcerative processes and diverticula of the bladder, in senile atrophy of the organ, and occasionally in progressive paralysis, which led some authors to assume a trophic disorder in the latter case. Retention of urine is also found in neurosis, but rather seldom, and not of a high degree, incontinence being rather more frequent in this condition than retention.

Treatment of Retention.—The treatment of retention in the acute form consists in evacuation of the bladder. The following measures may be considered.

a. Catheterization.—First, catheterization of the bladder, with a soft English catheter or with a Mercier catheter. In many cases where catheterization is difficult, to overcome the hindrance without false passage is a matter of practice. Guyon recommends, therefore, gaining exact information as to the topical conditions by rectal examination.

b. Puncture of the Bladder.—If catheterization is impossible, but immediate relief is indicated on account of the retention, puncture

of the bladder must be performed. Albert emphasizes that one may forgive the young practitioner if he is not able to arrive at a definite diagnosis in a severe condition, but that it is inexcusable if he forgets to examine the condition of the bladder on benumbed sensorium and to give immediate relief on urinary retention. A straight fine trocar is introduced in the median line above the symphysis, and even a capillary trocar may be used if Potain's aspiration apparatus has been chosen. The removal has to be performed very slowly, for if it is done suddenly the atonic bladder is unable to contract rapidly enough, which may lead to hemorrhages.

c. Internal Urethrotomy.—The primary condition, whether a stricture or an acute or chronic affection of the prostate, must be taken into account before the method of treatment is chosen. In stricture, for instance, one will sometimes select internal urethrotomy, whereas, in other affections, *sectio alta* or the perineal median incision may become necessary.

d. Nonoperative Treatment.—In nervous retention of the urine, catheterization is first indicated, followed by the application of heat in the form of hot towels or thermophore on the region of the bladder and perineum. In some cases, treatment with the galvanic current, the anode applied to the lumbar region, the cathode to the symphysis, may bring about contraction of the bladder. Duchenne's "bladder excitator" and Guyon's bougie electrode instruments, in which the electrodes are directly introduced into the bladder, will not generally be used, for in most cases faradization will suffice.

Chronic Retention of Urine.—If the chronic retention of the urine is complete the patient is entirely unable to urinate spontaneously, and the persistence of life depends on the use of the catheter, which is passed once or twice a day, usually by the patient himself. In this way infections of the urinary passages are almost constantly brought about, determining the fate of the patient.

The incomplete chronic retention of the urine, *i.e.*, with retention of large quantities in the bladder on each micturition, is found in hypertrophy of the prostate, stricture, senile atrophy of the bladder, musculature, and in various nervous diseases. The disorders of evacuation are occasionally overshadowed by the manifestations of the renal insufficiency, for the kidneys are unable to secrete sufficiently against the increased retrograde pressure of the urine. This form of uremia always leads to gastrointestinal disorders. Patients complain of thirst, of dryness of the pharynx; they suffer from anorexia, constipation, or diarrhea. A high degree of polyuria may sometimes develop, and in this way this condition has occasionally been confused with diabetes insipidus, and at other times with gastrointestinal affections. The bladder is usually overdistended and hard as a board,

the hypertrophied trabeculæ often projecting into the lumen of the bladder. The removal of the residual urine by the catheter is of excellent service in these cases, especially if the physician himself performs the procedure with all aseptic precautions, so that we do not exchange an infection of the urinary passages for the removal of the urine; the increased urinary pressure must be decreased very slowly by removing gradually increasing quantities of residual urine.

Incontinence of the Urine.—Incontinence of the urine, if developing gradually, occurs at first only at night as a rule, and only after it has attained a severe degree, also at daytime. Dribbling of urine is occasionally found with urinary retention if it is due to local processes and spinal diseases. Dribbling of urine occurs sometimes independently of retention, as, for instance, in the pressure of calculi, foreign bodies, and neoplasms, and in tuberculosis of the bladder, in the puerperium, and in the involution of the urogenital organs in the climacterium.

We must distinguish between the true incontinence, which consists in a muscular insufficiency of the sphincter, and the false incontinence, consisting of the excessive desire to urinate, which must be yielded to by the patient, as in cystitis.

Concerning the forms of incontinence, we must distinguish the dribbling from the sudden burst of urine. Dribbling occurs in atony of the bladder, occasionally as ischuria paradoxa, sometimes in neurasthenics and older individuals after micturition. After evacuation of the bladder, small quantities of urine may remain in the urethra if the final impulse to evacuation was not sufficiently energetic. Especially old individuals and neurasthenics have the desire to empty the last drops by a shaking movement of the penis. If this is omitted, a few drops of urine may be emptied into the clothes after micturition. This accident, not of much significance of itself, often brings hypochondriacal patients to the physician from the fear of a severe urinary disease. Dribbling is found in children suffering from enuresis, and in masturbation.

Breaking through the Sphincter.—If the closure of the sphincter suddenly breaks through, the urine bursts out of the bladder in large quantities. This occurs physiologically in children and if consciousness is lost, in idiots, and in older women, for instance, if they sneeze or laugh. In the age of vigorous manhood it is usually a sign of severe disorder of consciousness, whereas in old individuals it may occur during sleep.

Enuresis.—This sudden breaking through of the urine is found in children suffering from the neurotic condition of enuresis. It must not be confounded with cases of congenital insufficiency of the sphincter, which is of much more unfavorable prognosis. The anamnesis of such a congenital disorder tells that children have never been

continent, and we are almost helpless against this disorder. The acquired enuresis, on the other hand, is a condition which usually heals spontaneously at the time of puberty. Those disposed to it are scrofulous, sickly, and anemic children, as well as those who have suffered from malaria. An intimate connection between enuresis and hysteria may be observed in many cases. In favor of this speaks the frequent occurrence of enuresis in boarding schools, explained by unconscious imitation.

In order to make this diagnosis all spinal and cerebral disorders must first be excluded, as well as epilepsy, which in its nocturnal form is frequently confused with enuresis. In local diseases of the intestines and of the bladder, and in all conditions leading to polyuria, enuresis may occasionally be observed; thus in interstitial nephritis, diabetes mellitus, and insipidus. Hypospadia, phimosis, epithelial adhesions between preputium and glans, also calculi in the kidney, bladder, or ureter, a changed composition of the urine, papillary excrescences, gonorrheal vulvovaginitis, cutaneous affections of the genitalia, fissures and polyps of the rectum, hernia, hydrocele, and finally dyspepsia and adenoid vegetations all are conditions which are believed to be able to produce enuresis reflexly.

The examination of the patient shows frequently that they by no means suffer from anesthesia of the bladder, but from a decreased tonus of the sphincter. Rectal incontinence is in some cases associated with enuresis.

Treatment of Enuresis.—The treatment of enuresis must first take into consideration the primary conditions: adenoid vegetations will have to be removed, preputial adhesions freed, masturbation hindered by careful attention, and constitutional anomalies, as anemia, combated *lege artis*. Otherwise the following measures will have to be considered. The patient should receive as little liquid as possible in the evening, the foot of the bed should be elevated so that the urine collected in the bladder does not press on the internal orifice, but accumulates rather in the fundus of the bladder. Bell has ascribed enuresis especially to the dorsal position during sleep, and tried to prevent it by binding a brush on the back. Corrigan tried to close the external orifice by adhesive plaster or a drop of collodion, and in this way to prevent the escape of the urine, which rouses the patient by a painful sensation. Punishment, of course not too brutal, will help in cases which are due to negligence in children who otherwise have a healthy nervous system. In the same way, frequent wakening of the children during the night will help. This is proved especially in the army where the sentinel has the duty of waking the bed-wetters at regular intervals to command them to urinate. This occasionally leads to recovery of a chronic enuresis.

Thure-Brandt recommended a special massage treatment which consists of six parts. The index-finger, introduced into the rectum, performs vibratory movements of pressure which are only slightly felt. Then the hands are pressed deeply along the iliac fossæ toward the sacrum and the fingers, held stiff, perform a vibratory movement, intended to stimulate the hypogastric plexus. This is followed by movements of resistance on the part of the patient, partly with bent and partly with stretched knees, against the attempt of the masseur to abduct the legs while the patient adducts them and *vice versa*. This is followed by tapotement of the sacral region, which aims to increase the tonus of the lumbar center, and finally the patient is asked to cross one leg over the other, repeatedly, and to make those movements by which one holds back the stool.

One may try to increase the extensibility of the bladder by advising the children to retain the urine for some part of the day, and gradually to increase this period. Injection of a 3 per cent. solution of boric acid into the bladder has been advised, to increase the elasticity of the organ, but one will have to see that all the liquid is again evacuated to prevent the development of cystitis.

As far as the medicinal treatment of enuresis in children is concerned, belladonna has been recommended in doses of 0.005 to 0.01 gm. according to the age.

Watson prescribes:

Rp. Atropin, 0.05
Aqua dest., 25.00

Twice a day as many drops as the child has years, given at 4 o'clock in the afternoon and at 7 o'clock in the evening.

Or

Rp. Tinct. rhois aromat.
Fifteen drops afternoons and evenings.

Or

Rp. Extr. fluid. rhois aromat.
Five to fifteen drops twice a day.

Seifert recommends :

Rp. Extract. Strychni., 0.003
Fer. carb. sacch., 0.1
Sacchar., 0.3
D. t. d. Nr. X :
D. S. One powder before going to sleep.

Half-baths, cooled down to 27° C. and lower, rubs, the cold sitz-bath, and fan douche are sometimes of good service. Babinski and Brisseny recommended lumbar puncture; Cathelin and Albarran, epidural injections. "The cornua coccygea of the sacral bone gives

the line in the middle of which the membrana obturatoria is penetrated. If one performs the injections into the canal of the sacral bone with a needle 6 cm. long (for adults), the injection will meet the root of the cauda equina without opening the dural sac." (Cited from Frankl-Hochwart.)

The injection of 5 c.c. of a $\frac{1}{2}$ per cent solution of cocain led frequently to urinary retention, and at present one injects very slowly 5 to 20 c.c. physiological salt solution, so that about 5 c.c. are injected in thirty seconds. If this dose is found insufficient, it may be increased up to 30 to 40 c.c. This method has sometimes given good results in nervous stranguria, in the various forms of incontinence and retention. These injections are only successful if a favorable result has already been obtained after three to four injections.

Emptying of the Bladder by Manual Pressure.—An important symptom, found sometimes in the entirely atonic bladder, is the manual expressibility of the organ. It occurs especially in tabes, progressive paralysis, compression myelitis, but also in local affections following suppurative prostatitis. This symptom is most frequently found in connection with the absence of the patellar and achilles reflexes. The patients themselves make use of this peculiarity of their bladder, pressing with both fists deeply into the abdomen above the symphysis. In every case of atony of the bladder the physician must look for this symptom; in many cases, it saves catheterization which on long continuation is never harmless.

Hypertonic Bladder.—In opposition to this form of incontinence is the hypertonicity of the bladder, to which v. Frankl-Hochwart and Zuckerkandl called attention. The urine is expressed involuntarily in a very forceful jet; the evacuation may be brought about by very slight stimulation, as scratching the skin with the finger-nail above the symphysis. This anomaly is chiefly found in compression myelitis and in pachymeningitis.

Relation between Dysuria and Incontinence.—Dysuria in many cases leads to incontinence. The absence of a mechanical obstacle and of the desire to micturate, the failure to notice the dribbling urine, speak for the nervous origin of this form of incontinence. A disproportion exists between incontinence and urinary retention, as dribbling appears even on slight degrees of the latter. Where urinary retention has led to incontinence, the primary condition must be treated first. But if we have to deal with a genuine muscular insufficiency of the bladder musculature, massage and faradization will be indicated. If the closure of the sphincter is insufficient, the sphincter may be stimulated to energetic contraction by the introduction of sounds. In some cases it will be necessary for the patients to carry a urinal.

Cystitis in Nervous Diseases.—In affections of the bladder due to

organic disease of the nervous system, cystitis usually develops very soon. Charcot considered it, like decubitus, as a trophic disorder, but at present we know it is always due to an infection.

Function of the Bladder in Nervous Affections (*Innervation of the Bladder*).—The innervation of the bladder is very complicated and by no means entirely understood. Without going into detail and neglecting the newer research on the function of the symphathetic centers, we may state that the center for the bladder reflex is supposed to lie in the third and fourth sacral segments, acting for the sphincter as well as for the detrusor. If this center is destroyed, the desire to urinate is extinct, and the bladder evacuates itself entirely automatically, leading, in time, after a state of retention, to atony of the bladder. The same behavior is sometimes found on higher localization of the diseased focus in the thoracic segments; in the same way as, since the publications of Bastian, one has frequently observed that the patellar reflex may be absent, even if a disease focus becomes established above the reflex arc; together with the reflex function of the bladder, the patellar and achilles reflexes usually disappear, too. However, there is no symptom-complex which of itself is characteristic of spinal disorders of the bladder. At any rate, one will think of a spinal origin of a bladder disturbance if the desire to urinate fails, if paralytic dribbling of the urine or expressibility exists.

Atony of the bladder may, in severe cases, be associated with atony of the rectum and impotence. If other motor disturbance is absent, and at the same time cutaneous anesthesia exists on the scrotum and the inside of the thigh, and the achilles reflex is absent, one may, with great probability, suspect an affection of the conus medullaris. The same picture may be produced by a disease of the cauda equina, which may be involved in spinal changes extending as high as the second lumbar vertebra. Manifestations of irritation in the form of pain, localized in the lower lumbar vertebræ and sacrum and irradiating toward the anus, may precede the symptom-complex described above.

a. Tabes Dorsalis.—Of spinal diseases associated with disorders of urination, tabes stands first. Even in the advanced stage of the disease no symptoms of the bladder or only transient ones may be found. In other cases it is just this urinary trouble which stands in the foreground of the picture, leading indirectly to death by an ascending pyelocystitis. Many patients complain of severe pain in the bladder region; in a number of cases a local affection may be found, in others it will be entirely absent. The desire to urinate is in some cases pathologically increased, in other cases completely lost. Pronounced dysuria with retardation of micturition is sometimes observed. Large quantities of residual urine may be found on exami-

nation after urination. Incontinence is often present, but the incessant dribbling of urine, often seen in diseases of the conus medullaris, is never observed. For in tabes there is only paresis and never paralysis. For a long period this loss of urine appears only at night; and only later also during the daytime.

b. Different Affections of the Spinal Cord.—In the other systemic diseases of the spinal cord, the bladder and rectal functions are usually intact. They are involved, however, in all diffuse affections of the spinal cord, produced by luxations and fractures of the vertebral column, by acute and syphilitic meningitis, by pachymeningitis cerebrospinalis hypertrophica, as well as by chronic syphilitic pachymeningitis.

The bladder manifestations may, in these diseases, even be the first symptoms. The increased frequency of micturition is at first striking, later on it ceases, and the urine passes through the urethra without being felt by the patient, who recognizes the evacuation of the bladder only by his wet underclothing.

Pain in the bladder and retention are observed in these patients relatively seldom. In compression myelitis, a hypertonicity of the bladder may sometimes be observed, to be followed later on by paralytic incontinence, whereas this latter condition develops in the more diffuse affections of the spinal cord only in the advanced stages; it may be found rather early and quite pronounced in diseases of the conus medullaris and the cauda equina.

c. Multiple Sclerosis.—Multiple sclerosis is, in its primary stage, occasionally associated with retardation of micturition, so that the patient complains that he must often wait for several minutes before the urine passes.

d. Syringomyelia.—Patients suffering from syringomyelia may never have urinary disturbances, but in some few cases these may be the initial manifestations. H. Schlesinger relates a case in which he removed 3 liters of urine by catheterization without the patient having had any knowledge of this enormous accumulation of residual urine.

e. Tumors of the Spinal Cord.—In tumors of the spinal cord and of its membranes, as well as in hematomyelia, and especially in hemorrhages into the conus medullaris, the stimulus to urination may be absent.

Urinary retention sometimes occurs at advanced age, and, farther, in convalescence from typhoid fever and malaria. Whether here there are changes in the cord or not, is not yet decided.

f. Cerebral Diseases.—The influence of the cerebral cortex on the evacuation of the bladder is absent in the infant, where a slight repletion of the bladder stimulates the sphincter to contraction reflexly, the action of the detrusor appearing when the bladder is more com-

pletely filled; the tonus of the sphincter decreases and the evacuation of the bladder is produced by the breaking through of the urine.

The adult possesses the faculty of inhibiting the contraction of the sphincter and of stimulating the action of the detrusor, and *vice versa*, of contracting the sphincter and of relaxing the detrusor, if he wishes to retain the urine on stronger filling of the bladder.

It is at least very probable that the innervation of the one muscle is always associated with the relaxation of its antagonist. This faculty, which is gradually learned, is of course lost the moment the sensorium is benumbed, and therefore in all diseases associated with disorders of consciousness there is involuntary evacuation of the urine. It is by no means to be considered a focal symptom if, in brain tumor, in an apoplectic attack, in senile or paralytic dementia, in various forms of coma, and in the course of severe infectious diseases leading to loss of consciousness we find incontinence. The incontinence of the epileptic attack is important for the differential diagnosis between it and the hysterical seizure.

Quite another significance have those disturbances of the bladder which sometimes are found in brain affections, in which consciousness is entirely undisturbed. It is here remarkable that unilateral lesions of the cerebral cortex occasionally lead to incontinence, nevertheless the innervation of the bladder is regulated by both hemispheres. The center for the bladder is supposed to lie in the upper third of the posterior central convolution. Czyhlarz and Marburg found subcortical centers in the optic thalamus, in the pons, and in the corpus striatum. We will find, therefore, especially in tumors, more rarely in abscess of this region, disorders of urination.

g. Polyneuritis.—In extremely rare cases, slight bladder disorders have been seen in the course of polyneuritis, but it is still questionable whether we are justified in considering them as peripheral, since spinal changes are by no means infrequent in polyneuritis.

h. Functional Neurosis.—Functional neurosis plays a great rôle in cases of urinary disturbance. They are persons, especially, who have had a gonorrhea, or still suffer from the difficultly curable remains of a chronic gonorrhea, and come now with hypochondriacal complaints in regard to their urogenital organs. It is often very difficult in these cases to decide what is functional neurosis and what has an anatomical basis. Sometimes they are not subjects of gonorrhea, but are people who have always lived in sexual abstinence or are habitual masturbants. Objectively, one finds a severe hyperesthesia of the urethral and cystic mucosa on introduction of a catheter, which may even increase to severe spasm of the sphincter. True pollakuria or only the fear of the necessity of urinating is frequently found.

Pseudoretention is frequently seen in nervous patients; it happens

often that patients asked to urinate in the physician's office are absolutely unable to do so. Manifestations of incontinence, due to neurasthenia, scarcely occur if we disregard the passage of a few drops of urine following micturition, which was mentioned above.

In hysterical persons, incontinence and pollakuria, or a diminished desire to urinate are much more rarely observed than in neurasthenia, but, if present, they are more obstinate in hysteria.

i. Epilepsy.—The involuntary passage of urine, sometimes combined with incontinence of the stools, spermatorrhea, and biting of the tongue, is more frequently observed in genuine epilepsy than in the symptomatic forms. Incontinence is often present in those forms of epilepsy which occur only at night, and is then often falsely interpreted. The children are often treated for nocturnal enuresis, whereas, in fact, we have to deal with epilepsy occurring only at night. The scars following the biting of the tongue will be of diagnostic value in such cases. One will inquire anamnestically whether the patient has suffered frequently at night from grinding of the teeth, or whether bloody foam has been seen on the mouth. A form of vesical or urethral aura has been observed in which the patient has peculiar sensations in the bladder or urethra immediately preceding an attack.

Enuresis nocturna is found sometimes in the course of Graves' disease or of chorea; urinary retention, on the other hand, in tetanus and tetany.

Treatment of Nervous Affections of the Bladder.—In absolute urinary retention, of whatever cause, the catheter must be introduced twice a day. However, it is the rule to omit the catheterization when it can be avoided, as in tabes, if the bladder is expressible or in hypertonic bladders, where micturition may be stimulated by rubbing the skin of the abdomen, or by other procedures usually well known to the patient.

In chronic, incomplete urinary retention, the residual urine will have to be removed at least once a week, if not oftener, to prevent the sequelæ of the high pressure in the deferent urinary passages, very injurious for the urinary secretion. The use of a thermophore or of Leiter's apparatus filled with hot water will often suffice in urinary retention to bring about micturition. In paresis of the bladder musculature and incontinence, as well as on loss of the impulse to urinate, the use of a psychrophore will be of value sometimes.

Of treatments with the electric current, the percutaneous faradization is to be preferred to the intravesical; also galvanic electricity has proved effectual in the hands of some clinicians.

The primary condition, of course, deserves great attention, beside the symptomatic treatment. In all syphilitic diseases of the nervous system one will perform an energetic inunction cure, and give sodium

iodid in large doses; in neurasthenics suffering from pollakuria, as well as in the incontinence of epileptics, one will give bromides. In neuralgia of the bladder, phenacetin and pyramidon, as well as lavage of the bladder with a 1 per cent. solution of cocain, and the introduction of opium or morphin suppositories into the rectum may be considered.

Urethral Reactions.—After interventions on the urogenital tract, chiefly after catheterization, but also after local diseases, more or less severe reactions are observed. Catheterization is not rarely followed by sudden rises of temperature which rapidly drop to normal and have a certain similarity with an attack of malaria in the initial chill and the following eruption of sweat. This accident is usually harmless, but in some cases has even led to death. The explanation of this urethral or catheter fever is not easy. In most cases it is probably due to infection, for we seldom see any reaction if the catheter passes without difficulty, whereas a violent reaction occurs if the obstacle has only been overcome with difficulty; nevertheless, the asepsis may in both cases have been handled in the same way. The incarceration of calculi in the urethra may be associated with such rises of temperature which are almost constantly present in lithotripsy.

In the course of a chronic affection of the prostate or a bacteriuria, elevation of temperature may exist for years. The fever may be of the regular, intermittent type or occur in attacks following afebrile intervals. The health and general condition may not be much affected by it. In other cases, the most severe picture may develop. On severe infection of the urinary passages, a febris continua may result, which really belongs in the group of pyemia and septicemia. The urogenous fever usually develops without participation of the kidneys; rather we have to deal mostly with the absorption of toxins and the infection of the urinary passages.

The prognosis is not unfavorable generally, as complete recovery may be brought about even in cases in which febrile attacks have existed for a long period. The chronic, febrile conditions with lingering course are most to be dreaded. The prophylaxis has, in the first place, to observe the most careful asepsis on catheterization. If infection of the urinary passages has once occurred, we will aim to institute recovery by drainage of the bladder and of the renal pelvis in the same way that we try to eliminate the toxins by cathartics and sweating precedures.

Treatment of Local Bladder Troubles.—The treatment of local affections of the urogenital system cannot be taken up in this book; the reader must be referred to special works on this subject. Yet a few important points may be mentioned.

Cystitis.—One of the most frequent causes of cystitis, especially

in adults, is gonorrhea, but this does not mean that the gonococci are at the same time the etiological agent of the bladder infection.

Cystitis in children is often the sequela of concretions in the bladder as well as of foreign bodies, but in most cases of an infection. As Escherich pointed out, this is very often due to the bacterium coli. Colicystitis in girls is incomparably more frequent than in boys, which points to the fact that the urethra is generally the way along which the colon bacilli immigrate into the bladder. That the bladder may be infected directly from the intestines through the peritoneum is shown by the occurrence of colicystitis in boys suffering from follicular enteritis. Beside the bacterium coli, numerous other microorganisms may cause cystitis. The symptoms consist of spastic pains in the region of the bladder, in the incessant desire to urinate, and in pain on evacuation of the bladder. Children cry when they are obliged to urinate, which they do frequently and in small quantities.

Diphtheria of the bladder, associated with diphtheric vulvovaginitis, and tuberculosis of the bladder are occasionally found.

The treatment consists in rest in bed, a bland diet of milk and mineral waters, and moist warm compresses over the symphysis. An infusion of the leaves of uva ursi is sometimes of good effect, and warm sitz-baths and opium suppositories may help against the tenesmus. The indication for disinfection of the urinary passages is fulfilled by rinsing with a 1/4 per cent, solution of lysol, and by the internal administration of salol, benzonaphthol, or urotropin, 0.2 to 0.5 gm. three times a day. Lavage with silver nitrate solution 1 to 2000 should only be employed in the chronic forms, associated with little tenesmus and slight pain.

As far as the cystitis of adults is concerned, one must first aim to find out its etiology, and to treat this primary condition. A stricture must be dilated, foreign bodies, calculi, and neoplasms removed without any fear of augmenting the cystitis. If residual urine in large quantities has been demonstrated, its regular evacuation by catheterization must be performed. Irrigation of the bladder should not be instituted too early, but one may begin early with the instillation into the bladder of a 2 per cent. solution of silver nitrate, up to 20 drops. The pain and the other symptoms are excessively increased by this procedure for a few hours, and may even last one or two days. This state of irritation is, however, soon followed by a considerable decrease of the discomfort. A repetition of this procedure should under no conditions be performed before the symptoms of irritation from the previous instillation have completely disappeared.

In chronic cystitis of adults, a nonirritating diet must be instituted. Alcohol and spiced foods have to be prohibited. Treatment

at a watering place will be found of advantage. The salicylates, salol and urotropin may be given internally, and the bladder may be rinsed out with an antiseptic solution, the quantity of liquid introduced never exceeding 200 to 400 c.c. Various antiseptics may be used; in very painful cystitis, Guyon obtained good results with a 1 to 3 per cent. solution of silver nitrate; in tubercular cystitis a 1 *pro mille* solution of sublimate is advisable.

Diagnosis of Urinary Calculi.—The diagnosis of stone in the bladder has been made since the earliest times by means of a urinary sound. Cystoscopy has improved this method very much in the last twenty years.

The presence of a stone may be suspected by the following symptoms:

1. Pain on urination, or sudden pain on concussion of the body, as, for instance, on horseback riding and driving over a rough road.

2. The occasional presence of pure blood in the urine.

3. By disorders of micturition, setting in suddenly and disappearing in the same way. Frequently there arise severe pains during urination, irradiating to the glans; the urinary jet is interrupted, or dribbling of the urine results. In other cases the pain develops only at the end of evacuation, when the contracted bladder directly touches the stone. In children, especially in boys, calculi are very frequent. These are usually acid concrements, originating in the kidney, which on alkaline reaction of the urine become coated with phosphates in the bladder.

Small stones may pass occasionally, and, becoming incarcerated in the urethra, may produce irritation and phlegmon. In the rectal prolapse of children, one must always think of the possible presence of stone in the bladder.

Treatment of Urinary Calculi.—Of all the surgical methods of the treatment of stone, the *sectio alta* has long been the method of choice, the lateral lithotomy being completely abandoned. The more and more highly developed technique of litholapaxy has made this method of crushing the stone in the bladder and at the same time removing the fragments, the most frequently employed intervention with the exception of suprapubic cystotomy.

Ultzmann defines the indications for both procedures in the following way: In males and in children the *sectio alta* is preferable to litholapaxy; the same is true if the calculi are very large and very hard, or fixed in diverticula of the bladder; also when litholapaxy is infeasible, as in severe stenosis of the urethra, due to hypertrophy of the prostate or stricture; and in purulent and putrid cystitis with no hope of recovery, and in purulent pyelitis and nephritis.

The perineal median incision is only made for very small calculi

and when at the same time stricture of the urethra may be removed by this form of intervention. The indications are different in women.

If the stones are not altogether too large, they may be extracted through the dilated urethra, or, in children, removed by litholapaxy. The latter method permits the removal of rather large stones which cannot pass through the dilated urethra. Only extremely large and impacted stones demand the *sectio alta.* In severe purulent and putrid cystitis, incision of the bladder through the vagina may be advisable, to supply ample drainage to the bladder.

INDEX

Abdomen, examination of, 431
in infantile exsiccation, 368
in mongolism, 468
navicular retraction in, in enterospasm, 372
of undernourished infants, 40
sensation of fullness in, in constipation, 373
Abdominal cavity, hemorrhage into, symptoms of, 514
crises, 455
hemorrhage, 514
muscles, protrusion of, in emphysema, 212
pain, 431
in infancy, 443
walls in tetanus, 253
Abscess, formation of, following subcutaneous injection of quinin, 64
paranephritic, leukocytosis in, lower than in paratyphlitic, 547
peritonsillar, closure of jaw in, 316
pulmonary, dyspnea in, 209
postdiphtheritic, 624
stercoral, following intestinal obstruction, 387
Acetanilid, see Antifebrin
Acetone, aceto-acetic acids and, in urine, 589
in carcinoma, 7
in stomach contents, 594
production of, and intermediate metabolism, 590
relation of, to diacetic acid, 591
seat of formation of, 590
source of, 589
Acetonemia following anesthesia, 596
Acetonuria, as measure of acidosis, 592
diaceturia and, in carcinomatous coma, 735
without coma, 733
effect of butyric acid on, 590
enterogenous, 594
hyponutrition and, 592, 593
in blood disease, 595
in cancer without cachexia, 592
in diabetes mellitus, 591
in digestive disturbances, 594
in exclusive protein diet, 593
in fever, 591
in inanition, 593
in infectious diseases, 591
in intestinal autointoxication, 595
in intestinal hemorrhages, 596
in liver diseases, 595
in nervous diseases and psychoses, 594
in the puerperium, 596
in recurrent vomiting, 594
occurrence of, 590
relation of, to carbohydrates, 590
to fats, 590
to proteids, 589
vomiting and, 301
Acetonuric vomiting, 594
diagnosis of, 595
pathogenesis of, 595
treatment of, 595
Achlorhydria in infants fed with carbohydrates, 42
Achondroplasia, see Micromelia
Achylia, gastric, connective tissue in stools of, 473
gastrica, 353
Acid, acetic, in stomach contents, 352
hyperesthesia of stomach against, 433
theory of Keller, 598
Acidismus, 717
Acidosis, as autointoxication, 643
dangers of, 592
fat assimilation and, 40
febrile, 75
genuine atrophy of infants and, 45
in carcinoma, 7
in coma dyspepticum, 735
in genuine atrophy of infants, 44
in periodical vomiting, 594
intermediate, tendency of childhood to, 591
Kussmaul's respiration and, 225
"relative," through loss of alkali, 596
sugar excretion in diabetes and, 589
Acids, fatty, in stomach contents, 352
neutralization of, in treatment of milk dyspepsia, 40
Acromegaly, 33
headache in, 688
symptoms of, 33
treatment of, 33
Actinomycosis, hemoptysis in, 513
of esophagus, 330
Acupuncture, in aortic aneurysm, 154
Addison's disease, dyspnea in, 224
heart in, 165
skin in, 3
temperature in, 82
Adenoid growth, dyspnea in, 195
facial expression in, 195
Adrenal extracts as hemostatics, 498
glands, diseases of, heart in, 165
Adynemia in Addison's disease, 165
Aëronauts, asphyxia of, 231
Agar-agar as cathartic, 379
Agrypnia in cerebral anemia, 697
Air embolism, dyspnea in, 220
in the heart, 87
hunger, subjective dyspnea, 190
moist warm, danger of, 61
Albumin content of exudates compared with transudates, 556
quantity of, excreted in various forms of nephritis, 578

Albuminous expectoration on puncture of hydrothorax, 562
Albuminuria, affected by ingestion of raw eggs, 578
albuminous substances in, 573
and gout, 580
cyclic, importance of vertical position in, 574
due to pressure on the kidneys, 574
family, 576
febrile, 576
following anesthesia, 576
following concussion of brain, 713
following urinary retention, 577
following vagotomy, 576
from circulatory disturbances, 577
in amyloid kidney, 579
in blood diseases, 578
in Bright's disease, 578
in carbon monoxid poisoning, 723
in contracted kidney, 580
in diphtheria, 623
in eclampsia gravidarum, 732
in gout, 580
in incarceration of movable kidney, 453
in prize fighters, 573
in the newborn, and uric acid infarct, 580
in trichiniasis, 554
in Weil's disease, 423
infectious, 576
lordotic, 575
neurotic and vasomotor, 576
of pregnancy, 577
of puberty, 574
on overexertion, 573
on overfeeding with heterogenous proteid, 573
orthostatic, differential diagnosis of, 575
relation of, to nephritis, 574
palpatory, 576
physiological, accidental, 573
prognosis and treatment of, 579
toxic, 576
traumatic, 576
true and false, 573
without casts, 583
"Albuminurie appendiculaire" in perityphlitis, 577
Albumosuria, alimentary, value of test for, 581
and fever, 582
following tuberculin injection, 582
occurrence of, 581
Alcohol, a drug, 76
acting on the accelerator nerves, 131
and kidneys, 576
as fat economizer, 17
as food, 14
as noxa in obesity, 21
as protein economizer, 76
in phthisis, 76
as stimulant, 15
chronic abuse of, and ruddy appearance, 1
excess of, single, sequelæ of, 725
in cardiac weakness, 139
in febrile diseases, 139
in fever, 76
inducing hemoptysis, 131
Alcohol, intoxication from, symptoms of, 725
Alcoholism, acetic acid in stomach contents in, 352
chronic, cachexia in, 7
intolerance for digitalis by mouth in, 159
jaundice in, 403
sequelæ of, 725
Alimentation, forced, 10
Allorrhythmia, definition of, 95
occurrence of, 95
Altitudes, high, hemorrhages at, 490
Amaurosis, complicating uremia, 731
on getting up after long rest in bed, 543
Ameba of dysentery, pathogenous for cats, 488
Ammonemia in uremia, 597
symptomatology of, 597
treatment of, 599
Ammonia, effect of meat diet on elimination of, 596
in the urine, 596
poisoning by, 719
urinary, in liver diseases, 597
increase of, in carcinoma, 597
in diabetes, 597
in fever, 597
in protein decomposition, 597
in uremia, 597
through acid formation, 596
through ammoniacal fermentation, 597
through liver insufficiency, 596
through loss of alkali, 596
value of, relative, definition of, 597
Ammoniacal fermentation within the bladder in cystitis, 597
Amnesia, retrograde, in concussion of brain, 713
in eclampsia of parturition, 732
Amputation, line of, determination of, 4
Amyl nitrite intoxication, face in, 1
Amyloid degeneration in bronchorrhea, 274
kidney, albumimuria in, 557
hydrops and urine in, 557
Amyloidosis, general, pathogenetic factors of, 557
of liver, 415
state of nutrition in, 167
Anabolism, 12
Anacrotism of pulse, 99
Anadenia gastrica, 353
Anal prolapse, replacement in, 461
Analeptics, choice of, in cardiac weakness, 139
Analgesia in tabetic arthropathy, 666
Anaphylaxis, 626
Anemia, arterial, of brain, see Syncope
cerebral, in melena neonatorum, 527
in paralysis of heart following diphtheria, 697
in quinin poisoning, 750
symptoms of, 697
vertigo in, 745
constipation and, 301
dietetic treatment of, 542
due to insufficient nutrition, 538
due to poisons, 538
due to respiratory poisons, 538
edema in, 553

Anemia, fatty degeneration of heart in, 179
febrile, 62
following loss of blood, 537
hydrobilirubinuria in, 539
in aortic aneurysm, 154
in carcinoma of stomach, 537
in hemorrhage from genital organs, 519
in internal hemorrhage, 163
in menopause, 24
in obesity, 20
in renal infarct, 577
in vasomotor neurasthenia of heart, 120
incontinence in, 52
intensity of heart sounds in, 104
leukocytosis in, 549
medicinal treatment of, 543
of infants in milk disturbances, 38
pernicious, cachexia in, 7
constipation in, 384
gastric functions in, 353
heart in, 179
increased uric acid excretion in, 609
pallor in, 1
profuse diarrhea in, 384
progressive, 539
retinal hemorrhage in, 529
temperature in, 82
pseudoleukemica infantum, blood picture in, 541
secondary, changes in the erythrocytes in, 537
severe, respiration in, 191
sudden, following abdominal hemorrhage, 514
toxic, 537
velocity of bloodstream in, 107
Anemic coma in pernicious anemia, 735
Anesthesia, acetonemia in, 596
crossed, 666
general, in heart affections, 139
glycosuria following, 588
in syringomyelia, 666
intoxication with chloroform and, 724
occurrence of, 666
peripheral and central, 667
sensorial, 667
Aneurysm, aortic, 152
contraindication for passing sounds in, 324
diagnosis of, 153
dysphagia in, 243
dyspnea in, 220
hemoptysis in, 513
pain in, 243
producing esophagus stenosis, 279
pulsation in, 102
relation of, to syphilis, 153
singultus in, 243
causing tracheal stenosis, 204
hemothorax in, 514
intracranial, 156
minute arterial, cause of intestinal hemorrhage, 505
of heart, see Heart
of hepatic arteries, causing melena, 505
of innominate artery, 155
Angina abdominalis, 237
aphthosa, ulcers in, 319
epiglottidea, 332
follicular, causing albuminuria, 577
fever in, 61
lacunaris, onset of, 314
pultacea, 315
ludovici, infiltration of oral floor in, 309
of scarlet fever, 318
parenchymatous, 316
pectoris, 109
and cardiac asthma, 237
and cholelithiasis, 449
and fatty heart, 238
carbon dioxid bath contraindicated in, 123
confusion of, with abdominal affections, 439
digitalis action in, 237
heart in 237
in diabetes, 178, 225
in old age, 238
jaundice following, 449
pain of, simulated by gastric ulcer, 434
primary diseases of, 237
sodium iodid in, 151
stenocardia, in obesity, 22
symptomatology of, 236
syncope in, 236
theobromin in, 240
treatment of, 240
vasomotoria Nothnagel, 239
vertigo in, 45
plugs of secretion in, 316
purulenta, 315
ulcerative, gum changes in, 307
ulcers in oral cavity in, 307
ulcerosa membranacea Vincentii, 319
Angioneurosis, hemorrhage in, 493
Angioneurotic edema in nervous diseases, 554
Angiospasm in angina pectoris, 239
Anhydremia, inspissation of blood in, 536
pathogenesis of, 536
Anilin poisoning, following use of antifebrin, 65
Anisocoria in aortic aneurysm, 153
in cardiac neurosis, 188
Annihilation, feeling of, in angina pectoris, 236
in neurasthenics, 236
Anomalies of development, 6
of nutrition, 6
Anorexia, febrile, effect of, 76
in ammonemia, 598
in chronic cardiac weakness, 118
in phthisis, 15
in undernourished infants, 41
in vasomotor neurasthenia of heart, 120
preceding ileus from coproliths, 395
sign of fever, 57
Anosmia, occurrence of, 667
Antagonism between different bacteria, 620
Anthrax, intestinal, bleeding ulcers in, 508
Antifat cures in fatty heart, 142
of obesity, 143
Antifebrin (acetanil), 65

Antifermentatives intestinales, 605
Antineuralgics, 686
Antipyretics, in children, 73
indication for, 64
intoxication with, 729
Antipyrin, 65
in children, 73
Antiscorbutic diet, 523
Antitoxin, ineffectiveness of, in heart changes of diphtheria, 170
of high valency, 626
passing into the milk, 622
therapy of diphtheria, local and general effect, 318
Anuria in incarcerated movable kidney, 453
in nephrolithiasis, 452
in oxalic acid poisoning, 718
in peritonitis, 385
in perityphlitis, 454
in proctitis, 456
Anus, open, in intestinal invagination, 393
prolapse of, 460
pain in, 461
Anxiety in cardiac affections, 109, 235
in paroxysmal tachycardia, 149
Aorta, abdominal, tenderness of, 241
Aortic aneurysm, 152
acupuncture in, 154
diet in, 154
heart in, 152
symptoms of, 153
treatment of, 153
Aortic insufficiency, high altitude contraindicated in, 122
Aortic lesions, 119
Aortic regurgitation, anacrotic pulse in, 99
recognition of, 119
Aortic sound, second, accentuation of, 104
Aortic stenosis, anacrotic pulse in, 99
Aortic system, congenital narrowing of, 111
Aortitis, in typhoid fever, 175
pain in, 242
Apex beat, absence of, 100
exaggerated, 100
and weak pulse, 100
in cardiac insufficiency, 118
in emphysema, 160
position of, in children, 100
in puberty, 100
Aphasia, brain processes in, 52
in embolism of left Sylvian artery, 695
in hereditary syphilis, 52
in uremia, 731
sudden spell of, in cerebral arteriosclerosis, 152
Aphonia in laryngeal paralysis, 202
in paralysis of vocal cords, 201
in sausage poisoning, 729
Apnea, expiratory, loss of consciousness in, 712
in Cheyne-Stokes respiration, 192
respiratory, tracheotomy in, 202
Apoplexy, cerebral, 691–695
closure of jaws in, 313
in arteriosclerosis, 152
pancreatic, 24
pulse in, 183
Appendicitis, 505, 546
simulated by cholelithiasis, 447
Appendix, contractions of, 442
incarcerated, simulating ileus, 397
Appetite, in chronic diphtheria, 318
loss of, 118
preceding ileus, 395
ravenous, following typhoid fever, 13
Argyria, 3
Aromatic substances in the urine, 599
in intestinal putrefaction, 599
Arrhythmia, compensation and, 94
following use of antipyrin, 65
forms of, 94
idiopathic, of childhood, 96
of heart, in carbon monoxid poisoning, 723
of puberty, 97
on muscular exertion, in cardiac insufficiency, 108
respiratory, 96
significance of, 96
Arsenic, melanosis through continuous use of, 3
poisoning by, first signs of medicinal, 544
symptoms of, 721
Arseniuretted hydrogen poisoning, symptoms, 722
Arteries, examination of, 111
tortuous course of, 111
Arteriocapillary fibrosis, relation of, to interstitial nephritis, 166
Arteriosclerosis, 150
abdominal pain in, 436
accentuation of second aortic sound in, 104
arteries to be examined in, 99
causing cardiac hypertrophy, 141
cerebral, vertigo in, 744
digitalis in, 132
hydrotherapy in, 151
in chronic nephritis, 166
in obesity, 20
intestinal, meteorism and cyanosis in, 465
kidneys in, 151
lime-free diet in, 151
pathogenesis of, 151
pneumatic chamber contraindicated in, 212
pulse tension in, 97
pulsus tardus in, 97
regimen in, 151
Arteritis, syphilitic, of brain, loss of consciousness in, 704
Arthralgia saturnina, in lead poisoning, 722
Arthritis deformans of spinal column, 252
Ascarides causing intestinal obturation, 395
causing jaundice, 409
Ascites, effect of, on circulation, 90
on heart, 164
in cardiac insufficiency, 126
in peritonitis, 571
portal stasis and, 555
puncture of, 561
Aspergillosis, hemoptysis in, 513
Asphyxia, 190
acquired, of the new-born, 229
congenital, of the new-born, 227
crystals of Charcot-Leyden in, 272
diarrhea in, 384

Asphyxia during tracheotomy, 205
in arsenic intoxication, 721
in carbon monoxid poisoning, 723
in chloroform anesthesia, 230
in chorea, 657
in curare poisoning, 230
in eclampsia infantum, 711
in goiter, 203
in intoxications, 230
in lead poisoning, 723
in pertussis, 208
intrauterine, sign of, 227
of aëronauts, 231
of the new-born, caused by meningeal apoplexy, 707
paleness in, 227
treatment of, 228
slow gasping respiration in, 190
through perforation of tubercular glands into trachea, 204
Aspirin in children, 73
Assimilation limit for sugar, 587
Asthma, adenoid growth and, 195
bronchial, climate indicated in, 223
due to reflex irritation, 221
dyspnea in, 218, 221
malaria and, 221
pain in liver in, 446
pathogenesis of, 221
spirals in sputum in, 271
symptoms of, 221
tonic spasm of diaphragm in, 650
treatment of, 223
cardiac, and angina pectoris, 237
digitalis in, 136
dyspnea in, 218
in arteriosclerosis, 220
picture of, 218
expiratory dyspnea in, 191
hay, 222
stone, 249
Asthmatic attacks in emphysema, 212
disorders, in chronic bronchitis of children, 206
Atelectasis, cough and, 261
in bed-ridden patients, 229
in premature children, 47
pulmonary, 229
heart in, 160
in cerebral hemorrhage, 229
in hydrocephalus, 229
in measles, 229
in scarlet fever, 229
in typhoid fever, 229
Atheroma of cerebral vessels, 152
Athetosis in microcephalia, 32
Atony, intestinal, partial, and constipation, 374
vascular, and ruddy appearance in, 1
Atresia ani, 389
recti, 389
Atrophy, in infants, genuine, 44
prognosis of, 44
theories of pathogenesis of, 44
therapy of, 45
native mother's milk in, 487
Atrophy, symptoms of, 44
Atropin poisoning, face in, 1
in children, 367
symptoms of, 729
test in bradycardia, 92
Dehio's, 189
Attack, apoplectic, temperature in, 54
Auscultation of heart in arrhythmia, 94
Autointoxication, autoinfection and, 642
bradycardia in, 93
causing loss of consciousness, 713
classification of, 642
dyscratic, 643
gastrointestinal, and angina pectoris, 239
in blood diseases, 644
in chlorosis, 384
in constipation, 374
in motor insufficiency of stomach, 346
in renal insufficiency of cardiac origin, 128
intestinal, acetonuria in, 595
in diarrhea, 600
nervous symptoms in, 645
occurrence of, 644
skin changes in, 644
table of, 645
therapeutical considerations of, 646
"washing out" of the organism in, 646
Autotransfusion, 498
in gastric hemorrhage, 503
in intestinal hemorrhage of typhoid fever, 506

Bacteremia, occurrence of, 615
Bacteriological stool flora in infants, 488
Bacteriology of feces, 487
Balantidium enteritis, 488
Balneotherapy in compensated heart lesions, 122
Banting's dietary in obesity, 143
Banti's disease, differential diagnosis of, 542
hematemesis in, 504
syphilis and, 542
Barium poisoning, through adulteration of flour, 719
Barlow's disease, see Moeller-Barlow's disease
Basedow's disease, antithyroidin in, 187
Biot's respiration in, 192
cough in, 261
diarrhea in, 363
dyspnea in, 226
enuresis nocturna in, 770
galvanization of sympathetic nerve in, 187
heart in, 186
increased temperature in, 54
nitrogen elimination in, 17
organotherapy in, 187
oxidation in, 17
palpitation in, 186
suggestive effect of treatments in, 187
tetany in, 654
tachycardia in, 92, 187
treatment of, 187
value of nutrition in, 17
vertigo in, 746
Bath, Brand, in typhoid fever, 67
brine, effect of, in obesity, 28

Bath, brine, in scrofula, 28
carbon dioxid, 123
cold, contraindication of, in fever, 66
electric (faradic), in heart disease, 123
half, 68
contraindications for, 68
hot and cold, in obesity, 28
in pneumonia, 209
sponge, 66
treatment in compensated heart lesions, 122
Bayard (Tardieus) spots, 491
Bednar's aphthæ, 308
Beer, action of, in cardiac lesions, 122
contraindication for, in cardiac lesions, 122
heart, of Munich, 141
pathogenesis of, 88
Bellocq's cannula, in epistaxis, 500
Bence-Jones albumosuria in bone affections, 582
Biedert's cream mixtures, 484
Bile, in vomited matter, 280, 344, 347
secretion of, in fever, 74
in cardiac insufficiency, 129
viscosity of, increased in jaundice, 403
Bile acids, action of, on heart, 93
duct, common, spasm of, 417
ducts, congenital defects of, 412
stenosis of, from kinking, 413
Bilharzia dysentery, intestinal polyposis in, 507
Bilharzia-flux, intestinal hemorrhage in, 507
Biliary congestion and cholangitis, 424
fever, pernicious, form of malaria, 426
obstruction, in small children, diet in, 409
Bilious pneumonia, 426
typhoid, 425, 426
Bilirubin, crystals of, in mucous stools, 477
in the stool, 471
Biot's respiration, 191
Blackwater fever, jaundice in, 426
Bladder, atony of, occurrence of, 767
cerebral centers of innervation of, 769
coinvolvement of, in diseases of kidney, 755
difficulty on emptying of, 757
disorders of, 755
in epilepsy, 770
in functional nervous disorders, 769
in polyneuritis, 769
ectopia of, incontinence in, 52
evacuation of, and cerebral cortex, 768
function, in nervous diseases, 767
hemorrhage from, 518
hypertonic, occurrence of, 766
innervation of, 767
involuntary evacuation of, in disturbed sensorium, 769
irritable (cystalgia), 462
manual expressibility of, 766
neoplasm of, producing pain in rectum, 462
nervous affections of, treatment of, 770
pain in, irradiating into rectum in carcinoma of, 756
localized in kidneys, 755
occurrence of, 756
paralysis of, 664
reflex tenesmus of, 756
Bladder, stone in, causing pain in rectum, 462
symptoms in, related to abdominal affections, 755
toxic hemorrhage from, 518
tumors of, hemorrhage in, 518
ulcers of, leading to hematuria, 518
Blindness, sudden, following hemorrhage, 529
Blood, alkalinity of, in carcinomatous coma, 735
in diabetic coma, 734
and pus, in stools in carcinoma, 383
at high altitudes, 537
changes in, in heart lesions, 128
changes in quantity of, 536
coagulation of, in cardiac insufficiency, 128
in pulmonary tuberculosis, 510
composition of, and heart action, 88
cryoscopy of, 550
diseases of, acetonuria in, 595
and constipation, 384
dyspnea in, 223
general treatment of, 542
heart in, 179
indicanuria in, 602
examination of, 535
extravasation of, followed by jaundice, 421
in cachexia, 7
in emaciation, 8
in stools, 479
appearance of, and peristalsis, 479
in occult hemorrhages of stomach, 501
in vomited matter, 344, 347
of the new-born, 535
specific gravity of, in heart failure, 128
in heat stroke, 78
Blood-corpuscles, in infants, 535
red, in secondary anemias, 537
under normal conditions, 535
Blood crisis, 549
Blood-letting in pericarditis, 146
Blood poisons, causing anemia, 538
Blood pressure, affected by strophanthus, 136
decreased by drugs, 152
fall of, in arsenic intoxication, 721
in hemorrhage, 494
in snake poisoning, 730
following exertion, 109
in Addison's disease, 165
in angina pectoris, 237
in arteriosclerosis, 151
in lungs in pericarditis, 146
in meteorism, 465
in onset of scarlatinal nephritis, 172
in pneumonia, 158
in right ventricle, 113
increased, by insomnia, 736
by irritation of dura mater, 182
epistaxis in, 499
related to hemorrhage, 490
through cough, 258
influenced by medullar centers, 182
lowered, through digitalis, 132
use of determination of, in administering heart tonics, 97
Blood serum, toxicity of, in eclampsia gravidarum, 732

Blood signs of regeneration, 537
Blood stream, velocity of, in chlorosis, 181
increased, 107
Blood supply of heart, disturbances of, 89
Blood-vessels, affected by digitalis, 132
in incompensated heart lesions, 127
Bloody sputum, in tracheotomized patients, 205
stools, in volvulus, 391
"Blue baby" (morbus cœruleus), 114
Body height, in years of age, 48
Body measurements of premature children, 46
Body surface in relation to volume in children, 72
Body weight, consumption of energy and, 13
false increase in, due to edema, 14
importance of determination of, in hydrops, 558
in different years of life, 49
in psychoses, 18
increase in, following surplus of calories, 13
in nephritis, 578
of man and woman, average, 49
relation of, to height, 8
Bone changes in Mœller-Barlow's disease, 523
Bones, fragility of, in Moeller-Barlow's disease, 523
painfulness of, 251, 252
Bothriocephalus anemia, 539
autointoxication in, 644
Botulism, encephalitis complicating, 701
B-oxybutyric acid, in carcinoma, 7
in inanition, 593
mother-substance of acetone and diacetic acid, 591
Bradycardia, atropin test for, 92
cardiomuscular, 92
central, 182
digitalis contraindicated in, 135
due to autointoxication, 93
due to hypersaturation with CO_2, 79
following use of cardiotonics, 93
in acute lead poisoning during colic, 722
in Addison's disease, 165
in barium intoxication, 719
in brain abscess, 183
in cerebral apoplexy, 69
in chronic lead poisoning, 92
in concussion of brain, 184, 712
in convalescence of diphtheria, 168
in coronary sclerosis, 93
in diabetic coma, 733
in freezing, 79
in functional disorders of nervous system, 182
in heart-block, 93
in hematoma of the dura, 708
in hysteria, 189
in influenza, 177
in jaundice, 59, 165, 405
in meningitis, 59, 91
in migraine, 189
in miliary tuberculosis, significance of, 160
in mitral stenosis, 93
in obesity, 22, 178
in opium poisoning, 727
in otitis media, sign of brain abscess, 184
Bradycardia in pleurisy, with congestion in brain, 161
in pneumonia, 157
in recurrent fever with jaundice, 425
in tobacco intoxication, 92
in tubercular meningitis, 182
in typhoid fever, 59
in scarlet fever, 171
of cardiac paralysis of diphtheria, 169
postinfectious, 93
preceding uremic attack, 731
pulse rate in, 92
reflex, 94
in gastric ulcer, 94
relative, in typhoid fever, 174
through meteorism, 465
toxic, 92
vagus degeneration in, 182
Brain, abscess of, diagnosis of, 701
headache in, 678
importance of surgical treatment in, 702
in typhoid fever, 702
pulse in, 184
simulated by purulent otitis, 702
symptoms of, 701
affections of, forced movements in, 743
concussion of, headache in, 681
vomiting in, 297
congenital hypertrophy of, headache in, 679
diseases of, constipation in, 386
hyperemia of, 699
pressure on, increased, signs of, 743
vomiting in, 297
puncture of, causing albuminuria, glycosuria and polyuria, 588
tumor of, death in, 183
disturbed consciousness in, 702
localization of headache in, 678
pulse in, 183
treatment of, 702
vertigo in, 743
vomiting in, 296
Breast feeding, in milk dyspepsia, 40
Breathing, superficial, in premature children, 47
Bright's disease, see Nephritis
paleness of skin in, 2
Bronchi, foreign bodies in, 248
Bronchial glands, enlargement of, 204
in tubercular processes, 249
swelling of, cough in, 260
tuberculosis of, coughing spells in, 267
Bronchiectasis, 206
clubbed fingers in, 5, 117
hemoptysis in, 512
pain in, 248
Bronchiostenosis, pain in, 248
Bronchitis, acute, cough in, 263
in epidemic jaundice, 422
and emphysema, 212
capillary, of children, 207
treatment of, 207, 263
chronic, 206
in obesity, 23
fibrinous, occurrence of, 206
hemorrhagic, sputum in, 512
in aged, 265

Bronchitis, in cardiac weakness, 118
in children, treatment of, 266
in compensatory disturbances, 126
in measles, 206
in typhoid fever, 206
of finer bronchi, cough in, 263
pain in, 247, 252
putrid, 206
and gangrene, differentiation of, 271
clubbed fingers in, 5
cough in, 265
indicanuria in, 601
treatment of, 263
Bronchopneumonia, dyspnea in, 210
following postdiphtheric paralysis of vocal cords, 201
in children, 158, 211
in diphtheria, 627
in trichinosis, 234
treatment of, 264
Bronchorrhea, puriform, 274
Buhl's disease, fatty degeneration of organs in, 528
Bulbar myelitis, deglutition in, 335
paralysis, acute, deglutition in, 335
progressive amyotrophic, deglutition in, 335
Bulemia following typhoid fever, 8
Bulimia, in helminthiasis, 289
Burning of pharynx in infants, 305
Burns, causing suprarenal hemorrhage, 532
duodenal ulcer following, 360
Buttermilk (Holland milk), 485
preparation of, 486
Butyric acid, effect of, on amount of acetone excreted, 590

Cachexia, 6
edema in, 554
in chronic alcoholism, 7
in chronic arsenical poisoning, 722
in heart disease, liver and kidney affections, 7
in lead poisoning, 7
in malaria, 7
in mercury poisoning, 7
in myoma of uterus, 7
in pernicious anemia, 7
in phosphorus necrosis, 306
in scurvy, 521
metabolism in, 7
rapidity of development of, 7
temperature in, 83
treatment of, 8
Caffein, 137
as excitant in fever, 76
Caisson disease, 220
prophylaxis of, 220
Caisson workers, pulmonary hemorrhages in, 491
Calcium metabolism and phosphaturia, 585
Calf, cramps of, occurrence of, 651
Caloric consumption in Basedow's disease, 17
Caloricity of infant food, 35
Calorie loss through loss of sugar in diabetes, 588
requirement for the new-born, 75
in fever, 74, 75
Calorific value of nutrient enemas, 340
Camerer's law, 36
Camphor as analeptic, 138
Cancer, acetonuria in, 592
protein decomposition in, 592
Candy, green colored by copper, causing intoxication, 723
Capillary pressure, increased, in edema, 552
Caput obstipum, see Wry-neck
Carbohydrate fermentation, odor of stools in, 472
Carbohydrates, as protein enconomizer, 27
as subcutaneous food, 342
disorders due to 41
in infants, 41, 42
importance of, in milk dyspepsia, 39
in infants' stools, 483
restriction of, in antifat cures, 143
use of, in mast cure, 15
value of, in obesity cure, 27
in rectal feeding, 338
Carbolic acid poisoning, symptoms of, 725
Carbon dioxid bath, 123
in paroxysmal tachycardia, 170
gas, suffocation by, 230
intoxication, as autointoxication, 646
poisoning, acidosis in, 597
temperature in, 83
Carbon monoxid intoxication, dyspnea in, 230
encephalomalacia in, 696
face in, 2
hemorrhages in, 492
symptoms of, 723
Carcinoma, fatty heart in, 142
gastric, achlorhydria in, 350
atrophy of gastric glands in, 353
cancer-cell nests in the sediment in, 352
gastric contents in, 353
gastric motility in, 345
hematemesis in, 501
lactic acid bacilli in, 353
pain in, 435
increased ammonia excretion in, 597
intestinal, 383
blood and mucus in stools in, 508
mobility of, 396
leukocytosis with eosinophila in, 549
metastasis in the bone marrow announced by blood picture in, 549
in vertebra in, neuralgic pains in, 254
of bladder, hematuria in, 518
of esophagus, 330
of esophagus, pylorus, and intestine, 7
of gall bladder, jaundice, in, 412
of gastrointestinal channel, palliative operation in, 7
of kidney, hematuria in, 517
of larynx, 334
of rectum, tenesmus in, 384
of sigmoid and sigmoditis 396
of the tongue, 310
of uterus, metrorrhagia in, 519
on the cardia, pain in, 436
peptonuria in, 582
relation of, to gallstones, 409

Carcinoma, toxins of, effect of, 7
ulcerative intestinal, test for alimentary albuminuria, 581
urobilinuria in, 612
Carcinomatous cachexia, form of stools in, 373
coma, 734
Cardiac asthma, in granular kidney, 167
in scarlatinal nephritis, 172
treatment of, 218, 219
Cardiac crisis in tabes, 239
Cardiac insufficiency, acute, in obesity, 22
cause of death in obesity, 20
of fat persons, theobromin in, 137
Cardiac weakness, analysis of, 90
apex beat in, 100
causes of, 86
definition of, 85
heart sounds in, 103
lability of temperature in, 116
nycturia in, 117
Cardialgia from diseases of vessels, 436
nervous, 436
Cardiolysis, 247
in adherent pericardium, 148
in concretio pericardii cumcorde, 220, 569
Caries of the sternum, cold abscess following, 251
Carlsbad salt in fever of children, 70
Carminativa, 467, 468
Carotid artery, ligation of, in aneurysms, 155
Casein, importance of, for nitrogen deposit, 11
rôle of, in infantile dyspepsia, 39
stools, 39, 484
Castor oil in fever for children, 70
Castration, effect of, 26
in osteomalacia, 33, 252
Casts, dissolved through bacteria, 583
epithelial, in infectious embolic nephritis, 585
following use of salicylates, 583
forms of, 584
granular, 584
hyaline, in jaundice, 404
origin and significance of, 584
without nephritis, 584
in amyloid kidney, 585
in diabetic coma, 734
in jaundice, 583
in renal embolism, 585
in the urine, 583
number of, in various renal affections, 584
uric acid, in gouty kidney, 584
waxy, occurrence of, 584
without albuminuria, 583
Catarrh of rectum, mucus in stools in, 478
of small intestines, meat fibers in stools in, 474
mucous stools in, 477
stool findings in, 478
of upper colon and jejunoileum, mucus in feces in, 478
Catarrhal and decubital ulcers of intestines, hemorrhage in, 508
Cathartics, subcutaneous, 379
use of, in constipation, 378
Catheter fever, 771
Cauterization of mouth in infants, 305
Cavity formation in lungs, painlessness of, 233
Cephalæa agitata in influenza, 684
Cephalhematoma, 525
Cerebral hemorrhage, in obesity, 22
irritation, in constipation, 386
pressure, symptoms of, 702
Cerebrasthenia in school children, 679
vertigo in, 746
Cerebrospinal fluid, cytodiagnosis of, 703
in cerebrospinal meningitis, 639
Cerebrospinal meningitis, Flexner's serum in, 640
serum therapy for, 640
Character, change in, following cerebral hemorrhage, 693
Charcot-Leyden crystals in stools, 477
Cheeks, color and swelling of, in noma, 308, 309
Cheese intoxication, 730
Cherry stone ileus, 395
Chest, pain in the, 233
Chest wall, atrophy of, due to aortic aneurysm, 243
Chewing of gum in hyperchlorhydria, 433
Cheyne-Stokes respiration, 192
in morphin poisoning, 728
pupils in, 192
Chicken pox, leukocytosis in, 547
Childhood, metabolism of, 34
Chill, following use of acetanilid, 65
following use of antipyrin, 65
on overheating, 55
Chills in gallstone colic, 447
in kidney abscess, 453
Chlorids, absence of, effect of, on infants, 42
retention of, and edema, 14
in nephritis, 578
Chloroform anesthesia, asphyxia in, 230
indications and contraindications for, 724
poisoning, relation of, to anesthesia, 724
Chlorosis, as autointoxication, 602
blood picture in, 542
blooming color in, 1
constipation in, 377, 384
disposing to gastric ulcer, 501
dyspnea in, 224
edema in, 554
gastric atony in, 346
hypoplasia of vascular system and, 112
indicanuria in, 602
mobility of heart in, 101
nervous gastralgia in, 436
pallor in, 1
pathogenesis of, 602
rest-cure in, 542
specific gravity of blood in, 542
tendency to obesity in, 20
vascular system in, 179
Cholagogues 408, 448
Cholangitis, differentiation of, from Weil's disease, 424
in cholera, 424
in pneumonia, 424
suppurative, 423
relation of, to sepsis, 424

Cholecystitis and typhoid fever, 424
in cholera, 424
intestinal strangulation in, 391
localization of pain in, 431
Cholelithiasis and liver insufficiency, 447
cardiac weakness in, 163
pain in, 447
sequelæ of, 449
simulated by angina pectoris, 449
simulating ileus, 447
vomiting in, 294
Cholemia and syphilis, 429
dyspnea in, 226
hematemesis in, 504
hysterical, in benign jaundice, 417
mixed form of autointoxication, 644
picture of, 409
Cholemic coma, symptoms of, 735
Cholera, Asiatic, acetonuria and diaceturia in, 591
algid stage of, 82
anhydremia in, 536
asphyctic stage of, 82, 176
cholangitis in, 424
cholecystitis in, 424
facies hippocratica in, 5
heart in, 176
hot bath in, 69
measure of cardiac weakness in, 116
simulating sea sickness, 751
skin in, 5
stools in, 472
temperature in, 82
Cholera infantum, heart in, 177
vomiting, in 291
treatment of, 291
Cholera nostras, protein putrefaction in, 484
Chorea, endocarditis in, 188
following carbon monoxid poisoning, 723
Huntington's, 658
of pregnancy, 658
Chorea minor, 657
following cerebral rheumatism, 685
Chyme-infections in children, 43
Cicatricial strictures of intestines, 396
Circulation, reflex influence on, 89
Circulatory disorders, constipation in, 385
dietetic and physical therapy in, 568
disposition to heat stroke in, 78
in nervous diseases, 181
in obesity, 20
origin of, 85
tongue in, 129
Circumcision, danger of, in hemophilics, 524
Cirrhosis hepatis, hydrops of, 570
Laennec's, heart in, 164
of liver, constipation in, 385
skin in, 3
Claudication, intermittent, 3, 111
Climacteric period, early appearance of, in obesity, 24
Clubbed fingers, 5
Coagulation of blood in cardiac insufficiency, 128
Cocain intoxication, 729
Coccygodynia, 462
Coffee and heart hypertrophy, 21
Cohabitation, pain on, 463
Cold, sensation of, in congenital heart lesions, 81
Coldness of body, in collapse, 58
Coli colitis, 488
Colic, abdominal, effect of, upon heart, 163
bronchial, 249
causes of, 441
gallstone, 447
flatulent, enteralgia in, 440
in infants, pathogenesis of, 443
in barium intoxication, 719
in lead poisoning, 445
in pancreatic stones, 450
in perityphlitis, 441
in purpura abdominalis, 521
in rectal strictures, 450
renal, 451
stercoral, 374
following loss of water, 369
treatment of, 379
ureteral, in obstruction of ureter by coagulum, 517
Colicky pain 437, 438
in phosphorus intoxication, 720
independent from peristalsis, 441
on meteorism, 465
Colicystitis, occurrence of, 772
Colitis of infants, bloody stools in, 507
Collapse following ammonia poisoning, 719
following use of antifebrin, 65
following use of phenacetin, 686
in ammonemia, 598
in angina pectoris, 236
in anilin poisoning, 65
in carbolic acid poisoning, 725
in diabetes, 733
in gallstone colic, 447
in ileus, 399
in intestinal intussusception, 394
in nephrolithiasis, 451
in pancreas necrosis, 24
in pneumonia, 4, 157
in pneumothorax, 216
in typhoid fever, 4, 175
treatment of, 176
of heart, 117
in exudative pleurisy, 162
in pneumothorax, 162
pulse in, 58
temperature in, 58, 79
in children, treatment of, 84, 85
in congenital debility, 80
in septic infection, 81
tendency to, in influenza, 177
Collargol in septic fever, 70
Colon, atrophy of mucous membrane of, 479
digestive power of, 338
pain in, mistaken for gastralgia, 436
transverse, kinking of, 372
Coma, alcoholic, 725
anemic, in pernicious anemia, 735
carcinomatous, 734
diabetic, respiration in, 191
theories of pathogenesis of, 733

Coma, due to encephalitis in infections, 701
dyspeptic, respiration in, 735
following acute delirium, 700
in acute abscess of brain, 701
in acute hydrocephalus, 705
in atropin poisoning, 729
in brain tumor, 702
in concussion of brain, 713
in freezing, 79
in icterus gravis, 410
in meningeal apoplexy, 707
in morphin poisoning, 728
in pachymeningitis hemorrhagica interna, 707
in phosphorous intoxication, 720
in potassium chlorate poisoning, 719
in purulent meningitis, 707
in syphilitic basal meningitis, 704
saturninum, 723
uremic, 730
Combustion, deficient, in subnormal temperature, 79
in congenital debility, 80
in inanition, 81
Compensation, disturbed, mentality in, 126
of heart, 126
sleeplessness in, 126
failure of, frustrate contraction sign of, 104
Compensatory disturbances, physiological explanation of, 130
Compression, intestinal, by tumors, 394
Concretio pericardii, Broadbent's sign in, 103
cum corde, 102, 148
apex beat in, 102
venous collapse in, 113
diastolic collapse of cervical veins in, 102
paradoxical pulse in, 102
swelling of veins on inspiration in, 102
Concussion of brain, loss of consciousness in, 712
Congestion, terminal symptoms of, 243
venous, through cough, 259
Conjugated sulphuric and glucuronic acid in urine, 599
Conjunctivæ, in jaundice, 402
Consciousness, disturbed, in brain tumor, 702
in chronic lead poisoning, 723
in hysteria, 710
in Marshal Hall's disease, 704
in meat and fish poisoning, 730
in meningitis, 706
in syphilis of brain, 704
double, 710
loss of, 690, 712, see also Unconsciousness
in acute heart weakness, 117
in ammonia poisoning, 719
in arterial anemia, 697
in carbon monoxid poisoning, 723, 724
in cerebral anemia, 697
in concussion of the brain, 184
in diabetes, 733
in eclampsia of parturition, 732
in encephalitis, 701
in état de mal, 709
in expiratory apnea, 712
in internal pachymeningitis, 707
in intoxications, 513
Consciousness, loss of, in laryngospasm, 712
in Ménière's disease, 747
in sinus thrombosis, 699
in stenocardia, 110
in syphilitic arteritis of brain, 704
in syphilitic basal meningitis, 704
in tabes dorsalis, 222
in uremia, 730
pulse in, 183
with Cheyne-Stokes respiration, 192
Constipation, 368
alimentary, 639
and blood in the stools, 383
and enteroptosis (Glenard), 372
and neurasthenia, 372
and volvulus, 391
atonic and spastic, differential diagnosis of, 372
cause of rise of temperature in, 58
causing hypochondria, 373
causing rectal fissures, 459
cerebral irritation in, 386
chronic, treatment of, 375
diet indicated in, 375
due to anatomical intestinal anomalies, 371
due to insufficient quantity of food, 369
emaciation following, 374
evacuation by rectal methods in, 377
faradization of abdomen in, 376
fever in, of children, 71
following incessant vomiting, 369
from inhibition through pain, 385
from physiological causes, 369
gastric symptoms in, 373
glycerin enemas in, in children, 377
habitual, 372
headache in, 373
hydrotherapy in, 3
in abdominal affections, 385
in advanced age, 151
in aortic aneurysm, 154
in arteriosclerosis, 151
in artificially fed infants, 369
in blood diseases, 384
in brain affections, 386
in breast-fed children, 370
in cardiac insufficiency, 129
in children, 370
in chlorosis, 377, 384
in cholelithiasis, 448
in chronic catarrh of small intestines, 359
in chronic intussusception, 394
in circulatory diseases, 385
in cirrhosis of liver, 385
in compensatory disturbance, 126
in congenital pyloric stenosis, 45, 381
in diabetes insipidus and diabetes mellitus, 369
in dysentery, 383
in emphysema, 385
in endocarditis, 385
in gastric ulcer, 381
in gynecological disorders, 374
in hyperchlorhydria and hypochlorhydria, 380
in intestinal anemia, 384

Constipation in intestinal atony, 381
in intestinal carcinoma, 383, 395
in intestinal tumors, 383
in irritation of splanchnic, 387
in jaundice, 381
in jejunal catarrh, 381
in lead poisoning, 386
in meningitis, 386
in myocarditis, 385
in nervous diseases, 386
in obesity, 20
in pedatrophy, 370
in peritonitis, 385
in perityphlitis, 385
in pregnancy, 374
in rickets, 370
in school children, 381
in vasomotor neurasthenia of the heart, 120
in weak convalescents, 370
in whooping cough, 369
in young girls, 384
indicanuria in, 599
injurious factors of, 374
massage in, 376
meteorism in, 465
objective findings in, 373
of premature children, 370
oil enemas in, 375
on exclusive meat diet, 375
on exclusive vegetable diet, 375
on kinking of the sigmoid, 371
on loss of water, 369
on rest in bed, 371
on sedentary life, 371
physical therapy of, 376
primary pathological, 371
relation of, to psychoses, 373
secondary, 380
in febrile diseases, 380
in stomach affections, 380
sequelæ of, 373
spastic, in enterospasm, 372
use of cathartics in, 379
through muscular atony, 370
use of cathartics in, 378
value of education in, 377
Constitutional diseases, hematuria in, 517, 518
Consumption, face in, 2
Continence, delayed, in children, 52
Convalescence, care for heart in, 119
peculiarities of metabolism in, 13
Convulsions at the onset of infectious diseases, 617
causing suprarenal hemorrhage, 532
in brain abscess, 701
in brain tumor, 702
in cerebral anemia, 649
in children intoxicated with alcohol, 725
in chronic hydrocephalus, 705
in chronic lead poisoning, 723
in copper poisoning, 723
in eclampsia of parturition, 732
in epilepsy, 709
in fever of children, 71
in hemorrhage of brain, 649
in hydrocyanic acid intoxication, 718
Convulsions in infants with intussusception, 339
in internal pachymeningitis, 707
in lead intoxication of children, 722
in melena neonati, 527
in oxalic acid poisoning, 718
in phosphorus intoxication, 720
in spasm of the glottis, 201
in uremia, 731
occurrence of, 649
of infants, in Winckel's disease, 421
preagonal, in acute heart weakness, 117
Cooling apparatus of Leiter in heart lesions, 124
Copper poisoning, pathogenesis of, 723
Coproliths causing ileus, 395
causing intestinal stenosis, 374
Cor juvenum (Krehl) in orthostatic albuminuria, 575
Coronary arteries, atresia of, 88
insufficiency of, effect of, 127
Coronary sclerosis, 88
and angina pectoris, 237
attacks of dyspnea in, 218
bradycardia in, 93
effect of, on cardiac muscle, 88
Coronary vessels, arteriosclerosis leading to fatty degeneration of, 142
Corrigan pulse, 97
Corset, constipation and, 372
Coryza, effect of, on nursing, 304
Cough, 257
barking, in larynx affections, 260
center for, and vomiting center, 257
croupy, 262
danger from, 258
hindrance of, and danger thereof, 258
hollow, in advanced phthisis, 260
hysterical, 260
in acute bronchitis, 263
in hemoptysis, 266
in hypostatic pneumonia, 265
in intubated children, 337
in laryngitis, pharyngitis, tracheitis, 262
in laryngo-stenotic attacks of children, 197
in pertussis, 208, 209, 266
in pneumonia, 264
in pulmonary tuberculosis, 265
in putrid bronchitis, 265
in swelling of bronchial glands, 260
indications for combating, 261
kinds of, 259
metallic, in croup of the larynx, 260
moist, dry, 259
nervous, 258, 267
noiseless, in postdiphtheric paralysis, 260
on distant nervous irritation, 257
on drinking, 268
on intubation and extubation, 268
on stimulation of auricular vagus, 257
of trigeminus in the nose, 257
painful, in fibrinous bronchitis, 248
region exciting, 257
sensory stimulus to, in vagus nerve, 257
significance of, 259
suppression of, in pain, 234
in pulmonary tuberculosis, 265
timbre of, 259

Cough, treatment of, 262
whooping, 260
Coughing, attacks of, in swelling of bronchial glands, 249
on puncture of hydrothorax, 562
Cow's milk, effect of, on HCl production, 351
Cramps, general treatment of, 656
of calf, occurrence of, 651
Cresol and phenolsulphuric acid in the urine, 604
Cretinism, anatomical findings in, 31
development in, 31
goiter in, 31
intelligence in, 31
nose in, 31
ossification in, 31
skin in, 31
skull in, 31
thyroid gland in, 31
treatment of, 31
voice in, 31
Crisis, 57
and pseudocrisis in pneumonia, 546
in pneumonia, 4
Croup, and catarrhal pneumonia, 211
laryngeal, cough in, 260
laryngostenosis in, 198
Crying of infants in milk disturbances, 38
sign of overfeeding, 35
Cryoscopy of blood, 550
Cryptorchismus, sign of prematurely born child, 46
Curare intoxication, asphyxia in, 230
Curschmann's spirals, 271
Cyanosis and dyspnea, 113
and jaundice, 416
areolar, in pneumonia, 157
autotoxic enterogenous, 116
due to snake venom, 115
following use of certain antipyretics, 65
general, 113
in Addison's disease, 165
in alcohol intoxication, 725
in anilin poisoning, 65, 115
in Asiatic cholera, 177
in burns of the skin, 115
in carbolic acid poisoning, 725
in carbon dioxid intoxication, 231
in cardiac edema, 566
in cardiac stasis, 26
in cavernous phthisis, 161
in cerebral hemorrhage, 691
in chronic cardiac weakness, 118
in cocain intoxication, 729
in collapse, 58
in concussion of brain, 713
in congenital debility, 80
in congenital heart lesions, 114
in diphtheria, 623
in dyspnea, 190
in fish poisoning, 115
in heat accumulation, 80
in high position of diaphragm, 163
in intestinal anthrax, 115
in intoxications, 115
with antipyretics, 729
in laughing gas intoxication, 115
Cyanosis in mitral lesions, 114
in morphin poisoning, 728
in obesity, 23
in pertussis, 208
in pneumonia, 158
in pneumothorax, 162
in polycythemia, 115
in potassium chlorate poisoning, 719
in premature children, 47
in pulmonary edema, 214
in scarlet fever, 635
in spasm of the glottis, 201
in tetanus, 226, 652
in vascular hypoplasia, 112
in Winckel's disease, 421
local, 3, 115
and coldness in spinal paralysis of children, 3
mixed, through mixture of arterial and venous blood, 115
of extremities in paroxysmal tachycardia, 149
on passing sounds, 324
on passing the stomach tube, 282
pathogenesis of, 113
symptom of pressure in aneurysm, 152
symptomatology of, 114
through anilin intoxication, 714
violet rash in, 6
Cylindruria and renal function, 583
in diabetic coma, 734
Cystalgia, 462
Cystinuria, 585
Cystitis and pyelitis, 583
causing pain in the rectum, 462
chronic, diet in, 772
in children, 772
in nervous diseases, 766
pyuria in, 582
symptoms of, 772
treatment of, 772
Cystoscopy, importance of, in bladder stones, 773
Cytodiagnosis of cerebrospinal fluid, 703

Danger from hemorrhage, 494
Darmsteifung, 387
Death, apparent, of hysteria, 189
cause of, in icterus gravis, 410
in melena neonatorum, 527, 528
in phosphorus poisoning, 416, 720
in rabies, 628
in uremia, 731
due to spasm and paralysis of vocal cords, 200
due to suffocation in perforation of empyema, 215
due to traumatic hemothorax, 513
during sleep, 130
fear of, in cardiac affections, 235
following chloroform anesthesia, 724
following loss of blood, 494
from asphyxia in pertussis, 208
from collapse in opium poisoning, 727
from hematemesis, 285
from inanition in esophageal stenosis, 327
from pulmonary hemorrhage, 513
from suffocation, Tardieu's spots in, 491

Death in brain tumor, 183
in cerebral hemorrhage, 692
in eclampsia infantum, 226
in epilepsy, 710
in hemopericardium, 514
in pneumonia, 158
in purpura fulminans, 520
in snake poisoning, 730
in suprarenal hemorrhage, 533
in syphilitic meningitis, 704
in tabes dorsalis, 767
in thymus affections, 533
leukocytosis in the agony of, 545
of fetus, in cholemia of mother, 430
of new-born, due to hemorrhagic diathesis, 526
rapid, in septic diphtheria, 623
sudden, due to heart thrombus, 87
following asphyxia in tracheal stenosis, 204
following heart rupture, 86
from edema of glottis following burning, 305
from embolic processes in brain, in lungs, 118
from exhaustion, in infants with coryza, 305
in anemia, 179
in children, with hyperplasia of thymus, 204
in chronic cardiac weakness, 118
in diphtheria, 169
in embolism of pulmonary artery, 211
in goiter, 203
in heart trauma, 86
in hemorrhage into thymus, 533
in obesity, 178
in pancreatic hemorrhage, 532
in pericarditis, 146
through syncope of the heart, 118
through freezing, in inebriates, 725
Debilitas vitæ, cause of, 44
symptoms of, 45
Debility, congenital, 80
nutrition in, 80
Decomposition, bacterial, value of determination of ethereal sulphuric acids in, 604
in consumption, 77
Decubitus, in chronic cardiac insufficiency, 126
Defecation, painful, effect of, 374
in prostate affections, 462
Degeneration, fatty, in fever, 62
of organs, in infectious diseases, 618
parenchymatous, in fever, 62
reaction of, 659
Deglutition, disturbed, in carcinoma of esophagus, 330
impaired, by syphilis of oropharynx, 322
by tumors of the pharynx, 322
causes of, 314
in angina lacunaris, 315
in chorea, 657
in ear affections, 324
in trichinosis, 330
through esophageal affections, 324
in laryngeal syphilis, 334
in laryngeal tuberculosis, 333
Deglutition, painful, in larynx affections, 332
in retropharyngeal abscess, 323
paralysis of, 334
on cocainization of fauces, 314
pathogenetic factors in, 662
spasms of, in hydrophobia, 628
Dehio's atropin test in bradycardia, 189
Dehydration in infants, 367
Delirium, acute, hyperemia of brain, 700
furibund, in cholemic coma, 735
in fever, 59
in iodoform intoxication, 725
in tetanus, 652
Delirium cordis, 94
in angina pectoris, 237
in chronic pulmonary tuberculosis, 161
Delirium tremens, alcohol as medicament in, 139
prodromal signs in, 726
prognostic significance of insomnia in, 739
provocation of, 726
treatment, of, 726
Dentition, delayed, 52
Depression, in fever, 62
mental, in cardiac disorders, 129
states of, in hydrophobia, 628
Dermatomyositis, edema in, 555
pain in pectoral and intercostal muscles in, 253
Deuteroalbumin in the urine of febrile patients, 74
Development, anomalies of, 6
and thyroid gland, 31
of infant, 51
physical and mental, of infants with dyspepsia, 39
Deviation, conjugate, of eyes in cerebral hemorrhage, 692
Dextrin and maltose in protein dyspepsia, 485
Dextrosuria with rotation to the left, 589
Diabetes, 586, see also Glycosuria
asthmatic attacks in, 225
collapse in, 733
complications of, 589
constipation in, 369
dyspnea in, 225
heart in, 177
indications for carbohydrates in, 734
loss of calories in, through glycosuria, 588
odor of stomach contents in, 348
oral ulcers in, 307
pneumonia in, 158
resistance to infection in, 589
respiration in coma of, 191
test for alimentary glycosuria in, 587
Diabetes insipidus, nutrition in, 10
Diabetes mellitus, acetonuria in, 591
and obesity, 20
cardiac symptoms in, 240
difficulty of treating emaciation in, 9
dryness of skin in, 5
enuresis nocturna in, 764
glycosuria in, 588
headache in, 687
incontinence in, 52
increased ammonia elimination in, 597

Diabetes, skin in, 3
vertigo in, 750
Diabetic coma, announced by acetone bodies, 592
respiration in, 225
symptomatology of, 733
theories of pathogenesis of, 733
treatment of, 734
Diabetic glycosuria, danger of, 588
Diacetic acid, in carcinoma, 7
Diaceturia in anemic coma, 735
in inanition, 593
occurrence of, 591
relation of, to acetonuria, 591
Diaphoresis in acute nephritis, 560
in renal insufficiency, 559
Diaphragm, abnormally high position of, 162
affections of, dyspnea in, 217
clonic spasm of, 649
pain in the, 280
painfulness of, in trichinosis, 234
paralysis of, act of vomiting retarded in, 302
occurrence of, 662
position of lungs in, 661
postdiphtheric, 624
position of, following ingestion, 215
in meteorism, 463
tonic spasm of, 222, 650
Diaphragmatic paralysis, treatment of, 662
pleurisy and perisplenitis, 450
Diarrhea, 358
alimentary, 358
anhydremia in, 537
bacteriotoxic, 363
dryness of skin in, 5
fat in, of infants, 477
flatulency in, 464
form and consistency of stools in, 472
from inanition, in gastrointestinal catarrh, 362
from intestinal decomposition, 358
gastrogenous, 359
general treatment of, 363
hydrotherapy in, 366
in ammonemia, 598
in arsenic and sublimate poisoning, 360
in asphyxia, 384
in bilious pneumonia, 426
in cardiac paralysis of diphtheria, 169
in chronic intussusception, 394
in digitalis intoxication, 133
in dysentery, 360
in endocarditis, 385
in gastroenteritis of children, 43
in icterus, 359
in infants, treatment of, 367, 368
in intestinal catarrh, 359
in intestinal infections, 630
in intoxications, 714
in malaria, 363
in opium poisoning, 727
in pancreas necrosis, 24
in paralysis of heart, 244
in scarlet fever, 635
in sublimate intoxication, 721
in tuberculosis, pulmonary, 361
Diarrhea in uremia, 363
in vomiting, 673
intestinal autointoxication in, 600
menu in, 365
nervous, 362
in Basedow's disease, 363
of infants, stool flora in, 488
on prolonged use of arsenic, 544
on rectal feeding of peptones, 338
paradoxical, 361
pathogenetic factors of, 358
produced by parasites, 362
septic, in noma, 309
stercoral, 373
in chronic enteritis, 382
summer, facies hippocratica in, 5
through reflex, 358
use of cathartics in, 359
with passage of mucus, pus and blood in ulcers, 360
Diastasis of recti muscles, in children, 440
Diastole, in fatty heart, 21
prevention of, mechanical, 86
Diazo reaction, diagnostic significance of, 606
in measles, 606
in tuberculosis, 606
in typhoid fever, 606
obscured by certain drugs, 607
occurrence of, 606
simulated by certain drugs, 607
Dicrotism in typhoid fever, 175
of pulse, and low blood pressure, 99
occurrence of, 98
Diet and stool examination, 481
cures, in nervous diseases, 17
for premature children, 47
in Basedow's disease, 17
in chronic constipation, 375
in diarrhea, 363–366
in gastric ulcer, 502
in hemorrhagic diathesis, 312
in incompensated heart lesions, 131
in obesity, 27
of infants, and stool examination, 482
Digalen, 134
Digestion, disorders of, due to constitutional anomalies, 43
due to infection in children, 43
in premature children, 44
energy production in, 35
in bottle-fed children compared with breast-fed ones, 369
peptic, influenced by caffein, 138
Digestive disorders, heart palpitation in, 149
in noma, 309
in phthisis, 15
of infancy, vomiting in, 290
Digestive organs, in cardiac insufficiency, 129
in obesity, 23
Digitalis, action of, on renal vessels, 132
on the heart, 132
active principles of, as substitutes, 134
as heart poisoning, 88
cumulative action of, 132
effect of, on the blood pressure, 132
in myocarditis, 132

Digitalis in paresis of vagus, 132
increasing dyspnea, 218
intoxication with, symptoms of, 132
therapy, in cardiac insufficiency, 132
Diphtheria, antitoxin treatment of, 318
bradycardia in, 93
chronic, 317
effect of serum therapy on, 317
danger of infection with, in general, 622
embryocardia in, 105
epistaxis in, 526
experimental, suprarenal hemorrhage in, 532
faucial, impairing deglutition, 316
onset of, 317
simple fibrinous, 316
symptomatology of, 623
gallop rhythm in, 106
half bath in, 69
heart in, 167, 623
hemorrhages in, 492
immunization of animals from, 622
incontinence in, 53
intubation in, 626
laryngeal, 198, 625
antitoxic treatment in, 198
diagnosis of, 198
epiglottis in, 332
intubation and tracheotomy in, 198
treatment of, 198
malignant, 623
myocarditis in, 145
nasal, and postdiphtheric paralysis, 625
symptoms of, 624
nephritis in, 623
of bladder, 772
of esophagus, 329
oxidation in, 55
paralyses in, 624
prognosis and treatment of, 625
pulse in, 168
septic, 318, 623
nutrition in, 318
simulating catarrhal angina, 317
simulating follicular angina, 317
specific treatment of, 622, 625
subnormal temperature in, 83
toxin, distant effect of, 623
tracheotomy in, 626
use of gargles and inhalation in, 626
vagus neuritis following, 185
vomiting preceding heart-death in, 301
Diplegia, central, and speech, 52
Distoma, causing jaundice, 409
Distomum infection, hemoptysis in, 513
intestinal polyposis in, 507
Diuresis, abundant, in opium poisoning, 727
in diabetes, 588
increased, in infants with carbohydrate disorders, 42
Dizziness, following use of salicylates, 65
in fever, 59
in opium poisoning, 727
in thyroidism, 32
Drastic purgatives, contraindications for, 380
Dribbling of urine, occurrence of, 763
Drinks, cold, as antipyretics, 72
Dropsy, see also Edema
cardiac, heart affections causing, 565
diagnosis of, 555
general considerations in, 551
in children, 569
in obesity, 22
Drunkenness, redness of face in, 2
Dryness of mouth in atropin intoxication, 729
of skin, a sign of heart weakness, 5
in diabetes mellitus, in granular kidney, 5
in fever, 4
in vomiting, dilatation of stomach, and diarrhea, 5
Dulness, pulmonary, following hemoptysis, 510
Dumbness, idiopathic, and central diplegia, 52
Duodenal stricture, bilious vomiting in, 347
Duodenal ulcer, blood in stools in, 501
causing hypersecretion, 288
hematemesis in, 286
in melena neonatorum, 528
normal serum in hemorrhage in, 498
vomiting and pain in, 285
Duodeno-jejunal catarrh, impaired fat resorption in, 476
Duodenum, compression of, 394
Durand's remedy in cholelithiasis, 448
Dysentery, amebic, 488, 506
stool findings in, 507
bacillary, 488, 506
diarrhea in, 360
symptoms of, 638
cholangitis in, 423
infectious, in childhood, 507
jaundice in, 427
pain in, 438
pus in stools in, 479
rectal neuralgia following, 463
sera in, 638
serum therapy in, 638
Dysmenorrhea in obesity, 24
Dyspepsia, in infants, 38
causes of, 38
nervous, mobility in, 345
of artificially fed infants, 483
of breast-fed children, stools in, 482
treatment of, 483
Dyspeptic disturbances in premature children, 47
Dysphagia, see also Deglutition
as bulbar symptom, 335
caused by nervous diseases, 334
in angina epiglottidea, 332
in aortic aneurysm, 243
in esophageal diverticulum, 327
in laryngeal carcinoma, 334
in larynx affections, 332
in lyssa and tetanus, 335
in mediastinal affections, 247
in psychosis, 336
Dysphagia sonora, 663
Dyspnea, 109
absence of, in catarrhal pneumonia of cachectics, 210
in functional diseases of the heart, 121
caused by pain, 191
due to adenoids, 195

Dyspnea due to foreign bodies in the larynx, 200
due to glottis edema, 199
due to hyperplasia of thymus, 204
due to laryngeal tumors, 199
due to lymphoma, 204
expiratory, in bronchitis of children, 207
in laryngeal stenosis, 204
febrile, 59, 174
forms of, 191
in bronchitis, 206
hysterical, 191, 224
in Addison's disease, 224
in adherent pericardium, 220
in air embolism, 220
in aneurysms, 204
in aortic aneurysm, 156, 220
in arteriosclerosis, 220
in asthmatic attacks of lead poisoning, 723
in Basedow's disease, 226
in blood diseases, 223
in bronchial affections, 206
in bronchial and cardiac asthma, 218
in bronchitis of children, 206
in bronchopneumonia, 210
in bulbar paralysis, 185
in caisson disease, 220
in capillary bronchitis, 207, 208
in carbon dioxid intoxication, 231
in carcinomatous asthenia, 191
in cardiac weakness, 118
in chlorosis, 181, 224
in chronic pulmonary tuberculosis, 214
in compensatory disturbance, 126
in coronary sclerosis, 218
in croupous pneumonia, 209
in diabetes, 225
in diaphragmatic pleurisy, 215
in diphtheria, 626
in diseases of the mediastinum, 246
in dry pleurisy, 215
in eclampsia, 226
in emphysema, 221
in endocarditis, 219
in epilepsy, 226
in exudative pleurisy, 215
in fibrinous bronchitis, 206
in goiter, 203
in heart diseases, 217, 218
in heart hypertrophy, 141
in hydropericardium, 220
in hydrothorax, 216
in laryngeal crisis, 201
in laryngeal croup, 198
in laryngeal paralysis, 202
in laryngeal tuberculosis, 199
in laryngitis, 196, 197, 198, 199, 200–202
in larynx affections, 196
in leukemia, 223
in malaria, 221
in meningitis, 191
in miliary tuberculosis, 211
in multiple sclerosis, 185
in nervous diseases, 226
in obesity, 22, 23, 178
in pericarditis, 219
in peripleurisy, 215
Dysynea in pertussis, 208
in pleural tumors, 191
in pneumothorax, 216
in pulmonary abscess, 209
in pulmonary edema, 213
in pulmonary embolism, 211
in pulmonary tuberculosis, 191
in renal affections, 224
in retropharyngeal abscess, 195
in rhinoscleroma, 194
in spasm and paresis of diaphragm, 217
in tabes dorsalis, 222
in tetanus, 226
in tonsillar abscess, 195
in tracheal stenosis, 203
in tracheobronchial stenosis by tubercular glands, 204
in uremia, 224
in uric acid diathesis, 224
in valvular lesions, 219
increased by digitalis, 218
inspiratory, in bronchitis, 206
nasal, 194
effect of, on nutrition, 194
nephritic, 224
nocturnal, in gout, 213
objective and subjective, 190
of cholemia, 225
on blood transfusion, 231
on overheating of body, 194
pathogenesis of, 190
prognosis of, 193
symptomatology of, 193
through blocked secretion, 270
through paralysis of recurrent nerve, 664
through pressure on recurrent laryngeal nerve, 203
violent, following extubation, 205
Dysuria from paresis of detrusor muscle, 759
from spasm of sphincter muscle, 759
in cancer of uterus, 759
in cerebral affections, 759
in postdiphtheric paralysis, 760
in pregnancy, 759
in proctitis, 456
occurrence of, 757
of nervous origin, 759
relation of, to incontinence, 766
spastic, micturition in, 758

Ear affections, impaired deglutition in, 324
Ebstein's cure in obesity, 143
Eck's fistula, urinary ammonia in, 596
Eclampsia, effect of, on the child, 45
gastralgia in, 437
of infants, 710
forms of, 711
pathogenesis of, 711
treatment of, 712
of parturition, pathogenesis of, 732
Eclamptic attacks of children, uric acid gravel in, 610
Eczema, weeping, in obesity, 26
Edema and chlorid balance, 14
and erysipelas, 118
and varicose veins, 558

Edema, angioneurotic, acute, eyelids in, 554
blue, of the hysterical, 115
cardiac, symptomatology of, 566
cerebral, in cardiac insufficiency, 130
collateral, diagnostic significance of, 554
in comatose patients, 554
inflammatory, in thyreoiditis, 186
diagnosis of, 555
following use of iodids, 555
idiopathic, of infants, 570
in amyloid kidney, 557
in anemia, 553
in atelectasis, 160
in cachectic conditions, 554
in children, 569
in chlorosis, 554
in chronic cardiac weakness, 118
in congenital heart lesions, 114
in diphtheria, 555
in disturbed compensation of the heart, 126
in elephantiasis, 555
in engorged kidney, 553
in erysipelas, 570
in erythemas, 555
in erythromelalgia, 554
in exhaustion, 120
in hemorrhagic purpura, 571
in infants with carbohydrate dyspepsia, 42
in leukemia, 553
in malaria, 558
in malignant tumors, 554
in nephritis, 552
in nervous diseases, 554
in obstruction of the portal vein, 553
in paralyzed members, 554
in paroxysmal tachycardia, 150
in Raynaud's disease, 554
in scarlatina, 555
in scarlet fever nephritis, 557
in serum exanthems, 555
in urticaria, 555
in vascular hypoplasia, 112
inflammatory, in polymyositis and polyneuritis, 554
in trichinosis, 554
of brain, in nephritis, 700
of cerebral cortex, 558
of chest wall, heart sounds in, 103
of face, in sinus thrombosis, 181, 554
of foot, in tetany, 570
of glottis, 199
of hand, in cardiac dropsy, 558
over sacrum, in orthostatic albuminuria, 575
pathogenetic factors in, 551
physiological, 558
pulmonary, 213
following aspiration, 213
following ether anesthesia, 213
following thoracocentesis, 213
following tuberculosis, 213
in epilepsy, 710
in gout, 213
in mental diseases, 213
in pneumonia 158, 210
in puncture of hydrothorax, 562
in renal diseases, 213
Edema, pulmonary, in uremia, 731
in whooping cough, 213
preceding death (agonal), 213
slight, in vasomotor neurasthenia of the heart, 120
terminal, in contracted kidney, 557
Effusion, toxic origin of, 617
Electrotherapy in nervous manifestations of aneurysm, 156
Emaciation, 8
following chronic constipation, 374
in carcinoma, 7
in carcinoma esophagei, 330
in catarrhal jaundice, 406
in hectic fever, 73
in psychosis, cause of, 18
relation of, to cachexia, 8
treatment of, 9, 10
Embolism, air, artificial respiration in, 87
clinical picture of, 87
in aortic aneurysm, 154
of brain, 695
and heart affections, 695
differential diagnosis of, 695
in young individuals, 695
pathogenesis of, 695
prognosis and treatment of, 696
of lungs, 211
in obesity, 22
of mesenteric artery, in chronic cardiac weakness, 118
melena in, 505
of spleen, pain in, 450
of Sylvian artery, 695
pulmonary, 87
pain in, 242
signs of, in weak heart, 88
Embryocardia, 105
in diphtheria, 623
Emetics, use of, in intoxications, 715
Emphysema, and obesity, 20
apex beat in, 100
asthmatic attacks in, 212
cutaneous, following tracheotomy, 627
dilatation of veins in, 112
due to cough, 258, 259
expiratory dyspnea in, 191
heart sounds in, 103
pain in, 252
pulmonary, constipation in, 385
heart in, 160
hemoptysis in, 511
in postinfectious neuritis of vagus, 186
second pulmonic sound in, 104
secondary, in children, 207
substantial, 211
in obesity, 23
treatment of, 212
treatment of cardiac disorders in, 160
Empyema, chronic, of lungs, clubbed fingers in, 117
of thorax, cough in, 259
fingers in, 5
Encephalitis, acute, in childhood, 701
non-suppurative, 701
hemorrhagic, in botulism, 701

Encephalitis in chronic lead poisoning, 723
pulse in, 183
Encephalomalacia in carbon monoxid poisoning, 696
pulse in, 183
Encephalopathia saturnina, headache in, 682
Endocarditis, acute, constipation in, 385
aortic, and angina pectoris, 238
diarrhea in, 385
dyspnea in, 219
embolism of spleen in, 450
fetal, leading to congenital heart lesion, 140
in diphtheria, 168
in measles, 173
in phthisis, 161
in scarlet fever, 171
in septicemia, 176
of scarlet fever, treatment of, 173
pneumococcal, 156
predisposing to cerebral hemorrhage, 691
ulcerative, hemorrhages in, 492
jaundice in, 428
Enema, abuse of, in crying children, 443
as aid in topical diagnosis of intestinal obstruction, 399
"blind" 443
nutrient, 338
according to Ewald, 340
calorific value of, 340
in children, 341
of Rosenheim, 340
thirst and analeptic, 341
water, as antipyretic, 73
Enteralgia at the time of menstruation, 439
general treatment of, 442
in flatulent colic, 440
in gout, 444
in helminthiasis, 439
in hernia of the linea alba, 440
in hysteria, 439
of children, 440
in larvate malaria, 444
nervous, 438
simulated by renal colic, 451
Enteritis, chronic, diet for, 365
croupous, caused by intestinal tumors, 509
fatty stools in, 476
follicular, relation of, to dysentery, 507, 639
stools in, 639
in acidismus, 717
membranous, 383
mucus in stools in, 478
Enterospasm, constipation due to, 372
in abdominal crises of tabes, 455
in lead colic, 445
Enuresis, acquired and congenital, 763
in Basedow's disease, 770
pathogenesis of, 764
treatment of, 764
Enuresis nocturna in chorea, 770
Eosinophilia in scarlet fever, 547
occurrence of, 546
Epidural injection in enuresis, 765
Epigastric pain in catarrhal jaundice, 422
in gastric ulcer, 434
in pancreas necrosis, 24
Epigastric pain in pericarditis, 242
Epigastric pressure in dyspepsia of phthisis, 15
Epigastric pulsation, occurrence of, 101
Epigastric retraction, in paralysis of diaphragm, 662
Epigastrium, protruding, in spasm of diaphragm, 223
Epiglottis, swelling of, 196
Epilepsy, genuine and symptomatic, 708
genuine, pathogenesis of, 708
relation of attack of, to sleep, 709
in children, relation of, to spasms, 712
increased temperature in, 54
Jacksonian, headache in, 670
urinary disorders in, 770
vertigo in, 746
Epileptic attack, urinary incontinence in, 769
Epileptiform attacks in brain tumor, 702
in multiple sclerosis, 706, 745
in progessive paralysis, 710
Epispadia, incontinence in, 52
Epistaxis during sleep simulating hematemesis or hemoptysis, 499
from circulatory disorders, 499
in fracture of base of skull, 499
in hemorrhagic diseases, 499
in morbus maculosus Werlhoffii, 520
in nasal diphtheria, 624
in pertussis, 266
in the prodromal stage of acute infections, 499
of infancy, pathogenesis of, 526
preceding measles, 499
treatment of, 500
uncontrollable, in scurvy, 522
of the new-born, 524
with pathological findings in the nose, 499
Ergotin in aortic aneurysm, 155
Erysipelas, diazo reaction in, 606
edema in, 570
frequency of, in edematous patients, 118
in nephritic patients, 561
leukocytosis in, 548
of larynx, 333
trismus in, 313
Erythema, in atropin poisoning, 367
in serum disease, 626
in tubercular meningitis, 2
of face and trunk, 2
Erythema fugax, in scrofulous individuals, 2
Erythrocytes, changes in, in secondary anemia, 537
Esophageal carcinoma, pain on coughing and swallowing in, 248
diverticula, as hindrance of deglutition, 324
obstruction, symptoms of, 325
spasm, 279
stenosis, determination of location of, 324
murmur on deglutition in, 325
ulcers, 328
varices, bleeding from, 329
Esophagismus, occurrence of, 651
Esophagitis, acute, in children, 250
causes of, 328
exfoliativa phlegmonosa, 250
pain in, 325
phlegmonous, produced by sounds, 332

Esophagoscopy, 326
Esophagospasm, occurrence of, 651
Esophagotomy, feeding in, 336
Esophagus, actinomycosis of, 330
  affections of, pain in, 250
    type of vomiting in, 278
  anatomical lesions of, 324
  atresia of, 326
  carcinoma of, 330
    pain in, 250, 325
  catarrh of, 328
  cauterization of, by lye, 332
  cicatricial stricture of, 332
  congenital stricture of, 326
  diphtheria of, 329
  diseases of, impairing ingestion, 326
  diverticula of, 326, 327
  infections of, 329
  percussion and auscultation of, 325
  perforation of, 331
  stenosis of, diagnosis of, 279
    pathogenesis of, 278
    vomiting in, 278
  strictures of, following acidismus, 717
  syphilis of, 329
  thrush of, 250, 330
  tuberculosis of, 329
  tumors of, 332
Etat de mal in epilepsy, 709
Ether anesthesia, pulmonary edema following, 213
  as analeptic, 138
  as general anesthetic, 139
Ethereal sulphuric acids, relation of, to indicanuria, 603
Euchinin in children, 73
Exanthem, double, in scarlet fever, 6
Exanthematic typhoid, 6
  leukocytosis in, 548
Exanthems, acute, in general, 6
    skin discoloration after disappearance of, 427
Excitement in fever, 62
Exercise in obesity, 27
Exhalation, odor of, in diabetes, 734
Expectoration, 269, see also Sputum
  copious, 274
    in pertussis of children, 209
    occurrence of, 269
  in pulmonary abscess and gangrene, 271
Exsiccation by vomiting, 294
  in Asiatic cholera, 177
  in carbohydrate disorders, 42
  in cholera infantum, 177
  in congenital pyloric stenosis, 293
  in gastroenteritis of children, 43
  in infants, symptoms of, 367
Extra systole, definition of, 95
  occurrence of, 96
Extrauterine pregnancy, sudden paleness in, 1
Exudate, abdominal, in ileus, 398
Exudates, albumin content of, 556
  and transudates, differentiation of, 556
  specific gravity of, 556
Eyelids, edema of, in chlorosis, 554
    in sinus thrombosis, 554
Eyelids, place of first appearance of edema, 551
  swelling of, in serum disease, 626

Face, clefts in, 304
  in consumption, 2
  pallor of, 1
  redness of, 2
  stiffness of, in paralysis agitans, 658
Facial paralysis, acquired during birth, 664
  congenital, effect of, upon ingestion, 304
Facial paresis following cerebral hemorrhage, 692
Facial tetanus, 652
Facies hippocratica, significance of, 5
Fainting spells, in different diseases, 697
Farinaceous food, disorders due to, treatment of, 42
Fat, as subcutaneous food, 342
  diarrhea of infants, 477
  content of human milk, 463
  dyspepsia, feeding in, 485
    in children, 476
    intolerance for mothers' milk in, 482
    physiological, stools in, 471
    through infection, 489
  forms of, in stools, 475
  in chronic gastritis, 354
  in diet of overfeeding, 12
  in infant stools, 476
  loss of, in fever, 74
  macroscopical finding of, in stools, 473
  milk, as food in genuine atrophy of infants, 45
  necrosis, 23
  neutral, in stools, 475
  reduction mechanics of, 28
  resorption, impaired, 475
    in cardiac insufficiency, 129
    in infantile disorders, 476
    in jaundice, 405
  rôle of, in milk dyspepsia, 39
  sclerema, 569
  scleroderma, 80, 81
  value of, in rectal feeding, 339
Fatigue in obesity, 178
Fatty acid crystals (needles) in stools, 476
  degeneration of heart, 142
    of organs in Buhl's disease, 529
  heart, 141
    Banting's dietary for, 143
    caused by overfeeding, treatment of, 142
    diagnosis of, 142
    digitalis in, 132
    Ebstein's cure in, 143
    in carcinoma, 142
    in tuberculosis, 142
    Oertel's cure in, 143
    palpitations in, 111
    sounds in, 142
  liver, secretion of bile in, 415
  soaps in stools, 476
Febrile diseases, alcohol in, 139
Feces, acid reaction in, in jaundice, 476, see also Stools
  bacteriology of, 487
  cheesy masses and milk granules in, 474
  color of, 470

Feces, composition of, 469
connective tissue in, 473
examination of, 469
macroscopical, 473
microscopical, 474
form and consistency of, 472
form of, in abdominal crises of tabes, 455
in acute yellow atrophy of liver, 415
in icterus neonatorum, 418
in jaundice, 404
in recurrent fever, 426
meat particles in, 473
odor of, 472
presence of unchanged meat fibers in, 474
production of, on complete fasting, 470
quality of, and number of stools, 470
retention of, in ileus, 389
starch in, 474
unchanged food particles in, 469, 473
weight of, 470
Feeding, abundant, of children in convalescence, 37
artificial, calorie requirement in, 34
loss of weight in, 38
milk disturbances in, 38
breast, energy production in, 35
frequency of, 36
natural, calorie requirement in, 34
subcutaneous way of, 341
with stomach tube, 19
Fermentation dyspepsia, undigested starch in stools of, 475
Ferments, digestive, absence of, from stomach secretion, 352
sugar producing, in early infancy, 39
Fetor ex ore, in esophageal diverticulum, 327
in scurvy, 522
in stomatitis catarrhalis of febrile diseases, 306
Fever, 53
amphibolic state in, 57
and albumosuria, 582
and course of disease, 61
as cause of death, 58
aseptic, 54
bile secretion in, 74
calorie requirement in, 74
causal treatment of, 63
causes of, 54
danger of, 60
depression in, 62
dicrotism of pulse in, 98
dyspnea in, 194
excitants in, 76
face in, 2
feeding of children in, 37
following gastric hemorrhage, 501
general treatment of, in children, 70
glycogen consumption in, 75
height of, 58
hydrotherapy in, 63, 66
hysterical, 54
in angina epiglottidea, 332
in bacteriuria, 771
in brain abscess, 701
in cerebral hemorrhage, 692
Fever in childhood, treatment of, 71
in epidemic jaundice, 423
in infectious diseases, 56
in internal pachymeningitis, 707
in periaortitis, 242
in purpura abdominalis, 521
in retropharyngeal abscess, 323
in serum disease, 626
in tuberculosis, through injection of salt solution, 78
treatment of, 63
increased ammonia excretion in, 597
indications for therapeutic intervention in, 62
loss of fat in, 74
loss of weight in, 59
low, in diphtheria, 61
medicinal treatment, of 63
metabolism in, 59, 73
qualitative changes in, 75
muscle degeneration in, 62
nervous phenomena in, 59
nutrition in, 75, 76
nutritive treatment of, 73
on catheterization, 771
peristalsis in, 74
protein decomposition in, 73
protoplasma destruction in, 74
ptyalin action in, 74
rapid rise of, 57
regulation of, in children, 68
respiration in, 59, 191
septic, treatment of, 70
skin in, 4
slow onset of, 57
symptomatology of 57
tachycardia in, 91
tension of pulse in, 97
through resorption, 270
treatment of, 60, 63
types of, 57
typus inversus in, 57
urine in, 60
urogenous, 771
Fingers, clubbed, 5
cause of, 117
in bronchiectasis, empyema, and phthisis, 117
in chronic cyanosis, 116
in chronic jaundice, 117
in congenital heart lesion, 117
in enterogenous cyanosis, 116
Fish poisoning, 729
Fissure, rectal, in constipation, 374
Fistula, gastric or duodenal, indication for forming of, 313
Flatulence, following emotion, 441
in diarrhea, 464
pathogenesis of, 440
Flea bites, cutaneous hemorrhage due to, 519
Flexner's serum in cerebrospinal meningitis, 640
Fliess method of treating gastralgia, 437
Floury foods, disorders due to, 41
Focal symptoms, in cardiac insufficiency, 130
Fœtor ox ore, in cardiac insufficiency, 129
Fontanels in undernourished infants, 41

Food, farinaceous, derangements through, 41
nitrogenous and nonnitrogenous, 37
as flesh producer, 11
poor in sugar, 485
regurgitation of, in cleft palate, 303
requirement of, after first year of life, 36
source of infection in, 47
Forced alimentation, contraindicated in infancy, 35
Foreign body in bronchi, 248
in external auditory passage, 268
in larynx, 200
Fracture of bones in Moeller-Barlow's disease, 523
Freezing, 78
attempt at reanimation in, 79
symptoms of, 79
Fremitus, perihepatitic, in septicemia, 428
Frenkel's treatment, with methodical exercises, 661
Friction, action of, following bath, 72
Frigidity, peripheral, 116
"Frog abdomen" in infants, 468
Fusiform bacilli, occurrence of, 320

Gall-bladder, abscess of, signs of, 449
diseases of, 424
jaundice in, 424
Gallop rhythm in diphtheria, 168, 623
occurrence of, 106
of heart, 105
Gallstone colic, diagnosis of, 447
ileus in, 396
symptomatology of, 447
treatment of, 448
Gallstone disease, 163, see also Cholelithiasis
Gallstone ileus, 395
Gallstones causing jaundice, 409
producing intestinal hemorrhage, 505
relation of, to carcinoma, 409
Galvanic reaction in infants, 655
Gangrene, arteriosclerotic, 3
pulmonary, postdiphtheritic, 624
senile, following intermittent claudication, 111
Gärtner's fat-milk, 484
Gas emboli in caisson workers, 491
Gases, intestinal, exhalation of, by the lungs, 464
increase of, 464
Gastralgia, 432
and menstruation, 437
and pylorus, 436
and turbinates, 437
Fliess method of treating, 437
in Basedow's disease, 436
in chlorosis, 436
in cholelithiasis, 447
in eclampsia, 437
in tabes, 299
nervous, diagnosis of, 437
simulated by colon affections, 436
by gastric crises, 455
treatment of, 442
Gastrectasis, coma in, 346
tetany in, 346
Gastric crises, hemorrhage in, 505
pain in, 455
Gastric digestion and stool picture, 476
Gastric discomfort on prolonged use of arsen, 544
Gastric ferments, examination of, 349
Gastric hemophilia, 501
Gastric hemorrhage, 501
autotransfusion in, inadvisability of, 503
following operations, 504
in cirrhosis of the liver, 504
in pylethrombosis, 504
in stasis, 504
Gastric juice, disinfecting action of, in artificially fed children 290
Gastric mucosa, necrosis of, causing hemorrhage, 505
Gastric secretion, disturbances of, 350
Gastritis, acute, and chronic, mobility in, 345
constipation in, 380
therapeutical views of, 354
atrophic, 353
bacillary, 280
chronic, treatment of, 354
mobility and resorption in, 353
stomach contents in, 353
gastralgia in, 434
Gastroenteritis, eclampsia of infants due to, 711
of children, exsiccation in, 367
treatment of, 43
of infants, 43
symptoms of, 43
Gastrointestinal affections, vertigo in, 750
disorders, relation of, to psychical disorders, 78
thrush in, 308
infections in infancy, 290
Gastroptosis and pregnancy, 434
pain in, 434
Gelatin injection into aneurysmal sac, 155
Genital organs, female, pain in affections of, 455
hemorrhage from, 519
Genius epidemicus, 615
Germ and clinical picture, 54
Gingiva, gray line on, in use of sublimate, 721
Gingivitis in epidemic jaundice, 422
in scurvy, 311
Girdle sensations in tabes, 255
Glaucoma and hemicrania, 675
Globulinuria in nephritis, 578
Globus hystericus, 335
Glossitis, causes of, 309
Glottis, edema of, 199, 200
in thyroiditis, 203
occurrence of, 200
Glycogen as nutrient material, 342
consumption in fever, 75
Glycosuria, accidental, transient, 587
adrenalin, 587
alimentary, 586
in obesity, 26
in rickets, 587
occurrence of, 587
test for, according to Naunyn, 587
and diabetes, 586
and nervous system, 588
ex amylo, pathological significance of, 587

Glycosuria, ex saccharo, and diabetes, 586
following concussion of brain, 713
following opium intoxication, 727
in carbon monoxid poisoning, 723
in diabetes mellitus, 588
in pancreas necrosis, 24
on subcutaneous feeding of dextrose, 342
renal, through phloridzin, 588
temporary, transient, 587
Goiter, acute, dyspnea in, 203
cardiac disorders in, 186
colloid, cystic, treatment of, 204
congenital, 203
cough in, 261
dyspnea in, 202
glottis edema in, 200
iodin in, 203
malignant, hemorrhage in, 533
parenchymatous, treatment of, 203
retrosternal or retroclavicular, 203
sudden death in, 203
treatment of, 203
vascular, hemorrhage from, 322
impaired deglutition in, 322
wandering, 203
Goiter asthenia, 203
Goitre plongeant, 203
Goltz experiment, 89
Gonorrhea, black secretion in, 519
myocarditis in, 165
Goose flesh, 182
sign of chill, 2
Gout and albuminuria, 580
and lead intoxication, 723
angina pectoris in, 240
chronic, relation of, to meaty foods, 609
diagnosis of, 610
diet in, 444
gastric and intestinal, 444
respiratory disorders in, 224
thoracic pains in, 251
uric acid content of blood in, 609
of the urine in, 609
and diagnosis, 610
uric acid metabolism in, 609
vertigo preceding attack of, 750
Gouty kidney and genuine interstitial nephritis, 580
uric acid casts in, 584
Granular kidney, dryness of skin in, 5
Graves' disease, 186, see also Basedow's disease
acute angioneurotic edema in, 554
glycosuria ex saccharo in, 587
Group reaction of microorganisms, 631
Growth, extent of, in first month and years of life, 48
Gum, chewing of, in hyperchlorhydria, 433
Gums, bleeding, in angina ulcerativa, 307
changes in, in scurvy, 522
hemorrhages from, in morbus maculosus Werlhoffii, 520
in scurvy, 311
Gymnastics, medical, in compensated heart lesions, 122
respiratory, in compensated heart lesions, 122
in emphysema, 212
Hall's disease, 650
Hallucinations in fever, 59
Hanot's cirrhosis, jaundice in, 414
Harelip, influence of, on ingestion, 303
treatment of, 304
Hay asthma, 222
and gout, 224
Head, inability to raise, in infants, 51
position of, indicated on passing sounds, 324
Head's zones in organic heart diseases, 236
in thoracic affections, 256
Headache, a sign of thyroidism, 32
abuse of local cold application in, 682
at night, 677
cutaneous, Head's zones in, 671
hyperalgesia in, 671
dural, 677
false and true, 669
following concussion of the brain, 681, 713
following exertions, emotions, insolation, 681
following trauma, 688
forms of, 670
from cerebral congestion, 680
habitual, 682
hyperemic and anemic, 669
idiopathic, 689
importance of urine examination in, 669
in abscess of brain, 678
in acromegaly, 688
in acute articular rheumatism, 685
in acute miliary tuberculosis, 685
in anemias, 687
in autointoxication, 682
in brain abscess, 183
in brain tumor, 677
localization of, 678
treatment of, 678
in bronchitis, 685
in carbolic acid poisoning, 725
in cerebral anemia, 697
in cerebral atheroma, 152
in chronic pulmonary tuberculosis, 685
in coal gas intoxication, 723
in constipation, 373
in constitutional diseases, 687
in diabetes, 669
in diabetes insipidus, 688
in diabetes mellitus, 687
in empyema of frontal sinus, 684
in epidemic parotitis, 685
in epilepsy, 670
in erysipelas, 683
in exanthematic typhoid, 683
in gastric ulcer, 381
in Graves' disease, 688
in helminthiasis, 289
in hydrocephalus, 678
in hypermetropia, 688
in hysteria, 680
in infection, treatment of, 686
in infectious diseases, 682
in influenza, 684
in internal hemorrhagic pachymeningitis, 686
in intestinal autointoxication, 645
in jaundice, 405
in lead poisoning, 682

Headache in leptomeningitis, 677
in malaria, 683
in measles, 684
in meningitis serosa, 679
in menstruation and climacteric, 681
in migraine, 673
in nephritis, 687
of scarlet fever, 684
in neurasthenia, 679, 682
in nose, eye, ear and teeth affections, 688
in organic affections of the brain, 677
in orthostatic albuminuria, 575
in parasyphilitic affections, 686
in plethora vera, 687
in progressive paralysis, 686
in recurrent fever, 683
in scarlet fever, 684
in sinus phlebitis, 677
in smallpox, 684
in sunstroke, 78
in syphilis, 685
of the brain, 677
in tabes dorsalis, 686
in toxicosis and autointoxication, 681
in traumatic neurosis, 680
in typhoid fever, 683
in uremia, 687, 731
in uric acid diathesis, 688
in vasomotor neurasthenia of heart, 120
nervous, of school children, 679
neuralgic, supraorbital and occipital, 672
nocturnal, in abscess of brain, 678
in syphilitic meningitis, 704
of puberty, 681
on lumbar puncture, 703
pathogenesis of, 669, 670
periosteal, in syphilis, 673
persistent, in chronic pulmonary tuberculosis, 685
preceding cerebral hemorrhage, 691
preceding cerebral thrombosis, 696
pulsating, in cerebral aneurysm, 678
relieved by nose bleeding, 683
rheumatic, myositis in, 671
points of predilection in, 672
symptom of fever, 57
through reflex action, 689
vasomotor, 680
Hearing, disorders of, in hemorrhagic diseases, 530
Heart, action of, disturbances of, 85
in brain affections, 182
in disturbed compensation, 127
in fever, 58
in meteorism, 465
in sea sickness, 751
injuries of, 88
mechanism of, injured, 86
action of digitalis on, 132
affections of, insomnia in, 739
of the new-born, hydrops in, 570
tendency to syncope in, 698
aneurysm of, following myocarditis, 145
apex of, systolic retractions of, 102
arrhythmia of, in Basedow's disease, 187
atrophy of, in juvenile diabetics, 178
Heart, block, bradycardia in, 93
conductibility in, 93
conductibility of the cardiac muscle in, 92
borders of, in control of treatment, 103
determination of, 103
changes in, in orthostatic albuminuria, 575
collapse of, 117
in pleurisy, 162
in pneumothorax, 162
compensatory disturbances of, 126
compression of, 86
congenital lesion of, oxygen consumption in, 116
temperature in, 116
contraction of, "frustrate," definition of, 104
pain in, 104
hindrance of, 86
contraction volume of, 89
dilatation of, in Basedow's disease, 187
in paroxysmal tachycardia, 169
in pneumonia, 90
significance of, 119
disease, action of sea-sickness on, 189
congenital, fingers in, 5
prognosis of, 119
diseases of, and obesity, 22
dyspnea in, 217
general treatment of, 121
leading to cardiac dropsy, 565
disorders of, as focal symptoms, 183
displacement of, in pneumonia, 157
dulness of, in chronic cardiac weakness, 118
in disturbed compensation, 127
in overfatigue, 127
in pericarditis, 146
right border of, prognostically important, 118
ergotin action upon, 136
failure, and hemoptysis, 512
cause of death in rabies, 628
fatty, 21, 141
and angina pectoris, 238
pathological physiology of, 21
fatty degeneration of, treatment of, 144
force and renal insufficiency, 553
functional capacity of, 108
functional disorders of, 188
functional examination of, 108
functional incapacity of, and obesity, 20
gallop rhythm of, 105
hypertrophy of, in nephritis, 166
in obesity, 21
signs of, 21
in scarlatinal nephritis, 171, 172
significance of, 119
hypoplasia of, 112
in abdominal affections, 163
in adrenal affections, 165
in angina pectoris, 237
in aortic aneurysm, 152
in Asiatic cholera, 176
in blood diseases, 179
in cholera infantum, 177
in chorea, 188
in chronic pulmonary tuberculosis, 161
in climacterium, 188

Heart, in constitutional diseases, 177
in diphtheria, 168, 623
in disturbed compensation, physical findings of, 127
in emphysema, 212
in infectious diseases, 167
in influenza, 177
in internal hemorrhage, 163
in intoxications, 189
in jaundice, 165
in kidney affections, 166
in liver affections, 164
in measles, 173
in miliary tuberculosis, 160
in pneumonia of measles, treatment of, 174
in nephritis scarlatinosa, 171
in obesity, 22, 178
in pleurisy, 161
in pneumonia, 156
in pneumothorax, 162
in pulmonary atelectasis of the new-born, 160
in pulmonary emphysema, 160
in respiratory diseases, 156
in scarlet fever, 170
in sepsis, 176
in typhoid fever, 174
insufficiency of, digestive organs in, 129
primary disease of, 118
respiratory organs in, 128
insufficient nourishment of, 89
irregular, 94
irritable, 119
pathogenesis of, 119
lesions of, compensated, balneotherapy in, 122
diet in, 121
mechanotherapy in, 123
Nauheim bath in, 123
Nauheim treatment in, 124
treatment of, 121
medicinal, 125
congenital, 140
clubbed fingers in, 117
cyanosis in, 114
pains in, 109
pathogenesis of, 130
temperature in, 81
fingers in, 5
incompensated, blood changes in, 128
blood-vessels in, 129
diet in, 131
treatment of, 130
prognosis of, and state of nutrition, 22
massage of, in asphyxia after tracheotomy, 205
mobility of, in emaciation, 101
movable, 96, 101
diagnosis of, 101
pain in, 236
murmurs, 106
accidental, on systole, 106
muscle of, affected by strophanthus, 136
changes of, in fever, 60
dilatation of, 140
fatty degeneration of, 142
Heart, muscle of, idiopathic hypertrophy of, 140
treatment of, 141
inflammatory processes of, 165
toxic injury of, 89
nervous affections of, 119
nervous disorders of, in chlorosis, 180
nervous influence on, 89
neurasthenia, vasomotor, of, 188
neurosis of, with small goiter, 187
objective examination of, 108
of neurasthenics, 119
overdistention of, palpitation in, 111
pain in, in tetanus, 252
position in, 233
pain over, 109
paralysis of, cause of death in freezing, 79
in arteriosclerosis, 150
in diphtheria, 168, 169
in epilepsy, 710
in morphin poisoning, 728
in pancreatic hemorrhage, 531
pendular rhythm of, 105
poisons, action of, on cardiac muscle, 88
reduplication of second sound, 105
reserve force of, in tachycardia, 85
reserve power of, and palpitation, 110
in cardiac hypertrophy, 141
right auricle of, ultimum moriens, 190
rupture of, 86
sounds, in fatty heart, 142
in obesity, 21
intensity of, 103
together with low pressure, 104
weak, significance of, in children, 104
standstill of, experimental, 182
sudden arrest of, 86
sudden dilatation of, demonstrable by percussion, 103
supporter for, in cardiac disorders, 125
syphilis of, and angina pectoris, 238
systolic retractions of, 102
thrombus of, 87
and mitral stenosis, 87
tonics for, 132, 137
trauma of, 86
treatment of, in pneumonia, 158
vasomotor neurasthenia of, diagnosis of, 120
vibrations of (Herzflimmern), 110
weakness of, acute, 117
and exanthems, 6
chronic, 118
in diphtheria, treatment of, 170
in icterus gravis, 410
medicinal treatment of, 566
pain in the liver region in, 118
reanimation in, 117
use of diuretics in, 567
Heat accumulation, symptoms of, 80
centers, stimulation of, 57
economy and nervous system, 81
nervous centers of, 56
production and loss of, 55
regulation in fever, 53
stagnation of, in diphtheria, 55
stasis, by work, 78

Heat stroke, anhydremia in, 536
disposition to, 78
symptoms of, 78
Hectic fever in chronic tuberculosis and chronic septicemia, 73
Height of body, in years of age, 48
pulse frequency depending on, 90
Helminthiasis, achylia and hypersecretion in, 289
Charcot-Leyden crystals in stools in, 477
vertigo in, 750
Hematemesis, 285
in acute lead poisoning, 722
in appendicitis, 505
in Banti's disease, 504
in Buhl's disease, 529
in carcinoma of stomach, 501
in cholemia, 504
in cirrhosis of liver, 504
in duodenal ulcer, 504
in gastric crises, 505
in hemophilia, 504
in hysteria, 300
in melena neonati, 527
in purpura, 504
in pylethrombosis, 504
in sublimate intoxication, 721
in ulcer of stomach, 500
in uremia, 504
occurrence of, 285
preceded by euphoria, 285
Hematidrosis, 493
Hematoma of the dura of the new-born, symptoms of, 708
of the ear, 531
of the sternocleidomastoid muscle, 526
pharyngeal, 322
suprarenal, 533
Hematopoiesis, signs of degeneration of, 538
Hematoporphyrinuria, occurrence of, 583
Hematuria and hemoglobinuria, 583
chronic, in Moeller-Barlow's disease, 523
cystic, 515
cystoscopy and renal catheterization in, 515
differential diagnosis of, from hemoglobinuria, 514
due to parasites, 517
due to stasis in the bladder, 518
following urinary retention, 518
in constitutional affections, 517
in contracted kidney, 516
in diphtheria, 624
in hypernephroma, 517
in kidney abscess, 453, 517
in kidney infarct, 451
in kidney tuberculosis, 517
in kidney tumor, 517
in nephrolithiasis, 452,–516
in parenchymatous nephritis, 515
in pyelitis, 517
in renal infarct, 517
in renal thrombosis, 517
in scarlet fever, 515
in stone of bladder, 773
in toxic nephritis, 516
in tumors of the bladder, 518
Hematuria in ulcers of the bladder, 518
in vesical varices of the bladder, 518
renal, 515
Hemicrania, diarrhea in, 363
in epilepsy, 676
in tabes, 676
Hemiplegia, following diphtheria, 624
Hemoglobin content, drop of, in infectious diseases, 617
metabolism and jaundice in venous hyperemia, 416
Hemoglobinemia, fever in, 54
in jaundice, 412
in paroxysmal hemoglobinuria, 549
in picric acid poisoning, 419
paroxysmal, jaundice in, 421
pathogenetic factors in, 549
Hemoglobinuria, differentiation of, form hematuria, 514
following internal hemorrhage, 549
in arseniuretted hydrogen poisoning, 420, 722
in blackwater fever, 426
in pregnancy, 550
in Winckel's disease, 421, 529
on gelatin injection, 497
paroxysmal, liver and spleen in, 549
Hemolysis, fever in, 56
in paroxysmal hemoglobinuria, 549
Hemolytic poisons, leading to jaundice, 419
Hemomediastinum, 513
Hemopericardium, death in, 514
Hemophilia, congenital, hereditary influence in, 524
diet in, 525
gastric, 501
hematemesis in, 504
hereditary law governing, 524
hygiene of, 524
prognosis and treatment of, 524
trauma in, 524
tubercular, 492
uncontrollable epistaxis in, 524
Hemopneumothorax, 513
Hemoptysis and hematemesis, 500
and pulmonary hemorrhage, 509
and tuberculin, 513
danger of, in tuberculosis, 510
in actinomycosis, 513
in affections of bronchial glands, 513
in arteriosclerosis of pulmonary artery, 511
in aspergillosis, 513
in bronchiectasis, 512
in bronchitis, 512
in cardiopaths, 512
in croupous pneumonia, 512
in distomum infection, 513
in hemorrhagic infarct, 512
in lepra, 513
in malaria, 513
in pulmonary abscess and pulmonary gangrene, 512
in pulmonary emphysema, 511
in pulmonary trauma, 513
in pulmonary tuberculosis, 509
in tertiary syphilis, 513
in tuberculosis, treatment of, 510

Hemoptysis induced by alcohol in cardiac stasis, 131
initial, in tuberculosis, 509
of old age, 512
of pregnancy, 511
on perforation of pulmonary artery, 513
on the use of certain drugs, 513
simulated, in hysteria, 530
vicarious, 493, 511
Hemorrhage, abdominal, internal, pathogenesis of, 514
and disturbances of hearing, 530
and visual disturbances, 529
at great altitudes, 490
cerebral, differential diagnosis of, 693
duration of attack of, 692
in children, 691
in inflammatory reaction, 692
in pertussis, 266
in young people, 691
prognosis of, 694
sequelæ of, 692
symptomatology of, 691
treatment of, 694
vertigo in, 744
conjunctival, occurrence of, 530
course and sequelæ of, 494
cutaneous, in carcinoma, 735
in cholemic coma, 735
in scurvy, 522
in septic measles, scarlatina and diphtheria, 520
in smallpox, 520
cystic, in constitutional diseases, 518
definition and division of, 490
during sleep, 491
fatal, in aortic aneurysm, 152
following emotion or exertion, 491
following tonsillotomy, 533
from bladder, 518
from esophageal varices, 329
from umbilical wound, 526
from the ear, 530
from the genital organs, 519
from the urethra, 518
gastric, in carcinoma, 504
general treatment of, 494
hydremia following, 88
hysterical, 493
in abdominal wall, 514
in epilepsy, 531
in infections, 492
in infectious diseases, 618
in menopause, 24
in nervous diseases, 530
in pancreas, 24
in phosphorous poisoning, 492
in snake poisoning, 730
internal, heart in, 163
in gastric ulcer, 164
in hemorrhagic diathesis, 164
in morbus maculosus, 521
in tubal pregnancy, 164
in typhoid fever, 164
sudden pallor in, 1
intestinal, acetonuria in, 596
Hemorrhage, intestinal, in chronic cardiac weakness, 118
in phthisis, 480
in scurvy, 523
in typhoid fever, 4, 505
melena in, 505
through varicose veins, 505
into the thymus, 533
into the thyroid gland, 533
localization and danger of, 494
minute, as premonitory symptom, 491
of brain, convulsions in, 649
predisposing factors to, 691
symptoms in, 691
of esophagus, simulating hemoptysis, 509
of gums, in angina ulcerativa, 307
of neuropathics, 530
of the skin, 519
on puncture of ascites, 561
on puncture of bladder, 762
oral, in polyarthritis, rheumatic, 312
pancreatic, cause of death, 531, 532
pathogenesis of, 531
per diapedesis, pathogenesis of, 491
per rhexin, 490
produced by violent cough, 259
pulmonary, and hemoptysis, 509
in caisson workers, 491
in mental diseases, 530
renal, traumatic, 516
unilateral, in nephritis, 516
retinal, in blood diseases, 529
suprarenal, in asphyxia of the new-born, 532
in general venous stasis, 532
intra partum, 532
pathogenesis of, 532
temperature in, 82
tendency to, in icterus gravis, 410
through neurotic influences, 493
through stasis, 691
through vascular obstruction, 492
toxic, 492
in jaundice, 493
tracheal, following tracheotomy, 627
traumatic, in the new-born, 525
uncontrollable, in hemophilia, 524
vicarious, 530
Hemorrhagic diathesis, cutaneous hemorrhages in, 520
gastric hemorrhages in, 504
of the new-born, 526
oral affections in, 311
Hemorrhagic infarct, diagnosis of, 512
of cheeks and gums in scurvy, 311
Hemorrhagic pancreatitis, vessel changes in, 532
Hemorrhoids and carcinoma, 383
and constipation, 374
early symptoms of rectal carcinoma, 396
in obesity, 22
tenesmus in, 459
treatment of, 459
Hemostatics, acting indirectly, 495
chemical, local action of, 495
Hemothorax, pathogenesis of, 513
traumatic, 513

Hepatitis, interstitial, in syphilis, 429
Hernia, diaphragmatic, diagnosis of, 390
duodenojejunalis, 390
incarceration of, 389
inguinal and umbilical, and constipation, 374
Littré's, causing ileus, 397
produced by pertussis, 266
reposition of, 390
Herpes preceded by anal perineal pain, 462
Herpes zoster, pain in, 233, 255
Hiccough, hysterical, 649
in peritoneal affections, 649
occurrence of, by reflex action, 649
origin of, 649
pain in, 649
High altitude, living in, for compensated heart lesions, 122
Hirschsprung's disease, 371
Hoarseness in esophageal diverticula, 327
in gout, 224
in laryngeal tumors, 199
in laryngitis, 196
in paralysis of vocal cords, 201
Holland milk (buttermilk), 485
Humidity, atmospheric, and overheating, 78
Hydremia, 536
in renal affections, 552
Hydrobilirubin, coloring matter of feces, 470
Hydrobilirubinuria, sign of anemia, 539
Hydrocephaloid (Hall's disease), 650
in cholera infantum, 177
in gastroenteritis of infants, 706
Hydrocephalus, 52, 297
acute, symptoms of, 705
chronic, external, 679
headache in, 678, 679
relation of, to hereditary syphilis, 705
Hydrochloric acid, quantitative determination of, 349
poisoning by, 717
secretion of, in fever, 74
test for, in gastric juice, 348
Hydrocyanic acid intoxication, 718
asphyxia in, 230
odor of stomach content in, 348
Hydrogen sulphid intoxication, symptoms, of 723
Hydronephrosis, following loss of fat in obesity, 24
pain in, 454
Hydropericardium, dyspnea in, 220
heart force in, 86
in general dropsy, 556
paracentesis in, 562
puncture of, 562
simulated by dilatation, 147
Hydrophobia, duration of immunization to, 629
factors determining prognosis of, 628
hysterical, 663
incubation period in, 628
specific treatment of, 628
symptoms of, 651
Hydrops, see also Dropsy
cardiac, differential diagnosis of, from renal hydrops, 559
edema of back of hand in, 558
Hydrops, diagnosis of primary disease in, 557
from congestion, urine in, 557
general, in obstruction of the portal vein, 553
in amyloid kidney, 557
in diphtheria, 624
in emphysema, 160
in exudative peritonitis, 571
in heart affections of the new-born, 570
in liver cirrhosis, 570
in obesity, 178
in renal diseases of the new-born, 570
intensity of, in renal affections, 557
prognosis of, 558
renal and cardiac, 557
and sweating, 559
Hydrotherapy in acute nephritis, 560
in arteriosclerosis, 151
in chronic constipation, 377
in diarrhea, 366
in fever, 63, 66
of children, 72
in obesity, 28
in pneumonia, 159, 209
in scarlet fever, 173
in uremic coma, 732
Hydrothionemia, 464
Hydrothorax, dyspnea in, 216
puncture of, 562
unilateral, 555
Hyperalgesia in organic heart diseases, 236
Hyperalgesic zones of Head, 256
Hyperchlorhydria, 350
abdominal pain in, 432
diet and menu in, 433
in congenital pyloric stenosis, 292
in ulcer, treatment of, 356
Hyperemesis gravidarum, 295
Hyperemia, cerebral, active and passive, 699
irritative or depressing action of, 700
pathogenetic factors of, 699
treatment of, 700
fluctuating, in progressive paralysis, 185
of brain, vertigo in, 745
of meninges, 78
pulmonary, pathogenesis of, 511
test of Moszkowicz, 3
Hyperesthesia, in vasomotor neurasthenia of the heart, 120
thermic, 436
Hyperesthesia plexus hypogastrici, 439
Hyperesthesia plexus solaris, 439
Hyperglycemia, lowered resistance in, 588
Hyperpyrexia, in apoplectic attacks, 54
in epilepsy, 710
nervous, distinguished from fever, 54
Hypersecretion, chronic, of gastric juice, 433
rinsing fluid for, 284
gastric, 354
and hypochondriacal melancholia, 19
causes for, 287
treatment of, 355
vomiting in, 287
Hyperthermia following marching, 77
Hyperthyroidism, effect of, on metabolism, 17
heart in, 186
in fatty heart through thyroid extract, 143

Hyperthyroidism, medicinally produced, heart in, 186
Hypertonus of musculature in infants, 42
Hypertrophy of left ventricle, apex beat in, 100
of right ventricle, sternal pulsation in, 101
Hypnotics in insomnia, 738
Hypochlorhydria, 350
Hyponutrition due to proteins, in infants, 42
following constipation, 373
Hypophysis, hypertrophy of, 33
Hypoplasia of female generative organs in chlorosis, 180
of vascular system in chlorosis, 180
Hypospadia, incontinence in, 52
Hysteria and epilepsy, 710
convulsions in, 710
bloody vomiting in, 300
circulatory disorders in, 189
closure of jaws in, 313, 314
cough in, 267
cutaneous hemorrhage in, 493
deafness and blindness in, 667
deglutition disorders in, 335
disappearance of, in acute diseases, 618
dyspnea in, 224
fever in, 54
headache in, 680
hemorrhages in, 530
of children, visceralgia in, 440
phantom tumor in, 440
pseudo Ménière's disease, 746
respiratory disorders in, 227
simulating ileus, 398
suggestion in, 661
vertigo in, 746
visceralgias in, 440
vomiting in, 299

Icterus, bradycardia in, 93, 165
catarrhal, followed by progressive paralysis, 405
catarrhalis, temperature in, 165
chronic, clubbed fingers in, 117
diarrhea in, 359
ex emotione, 417
gravis, kidneys in, 410
picture of, 409, 410
venesection in, 411
heart action in, 59
melas, 403
neonatorum, 418
heart in, 165
of children, heart in, 165
precox, 429
subicteric tinge of, in heart lesions, 129
use of fats in, 359
Ictus laryngeus, 222
Ideas, compulsory, and fever, 54
Idiocy, and speech development, 52
"Idiopathic" renal colic, 453
ureteral colic, 453
Idiosyncrasies against certain foods, 481
and autointoxication, 644
Ileus, abdominal exudate in, 398
acute, symptomatology of, 388
adynamic, 398
Ileus, chronic, in intestinal carcinoma, 395
following intestinal thrombosis and embolism, 398
forms of, 389
from cicatricial strictures, 396
in uremia, 398
jactitation in, 397
nervous symptoms in, 389
paralytic, 396
in gallstone colic, 396
in intestinal sarcoma, 383
in peritonitis, 397
in renal colic, 451
persisting after reposition of hernia, 390
postoperative, 397
simulated by nephrolithiasis, 397
spastic, in lead and mercury intoxications, 398
special symptomatology of, 398
temperature in, 399
thirst in, 401
through cherrystones, 395
through gallstones, 395
through incarcerated hernia, 390
treatment of, 400
vomiting in, 288
Imbecility in congenital hydrocephalus, 705
incontinence in, 52
Immunity, lowered, in carbohydrate-fed infants, 42
natural, decreased through overfeeding, 178
Impotence and obesity, 26
Inanition, acetonuria in, 593
combustion in, 81
death through, in pyloric stenosis, 45
indicanuria in, 602
jaundice in, 430
threatening, in cancer of tongue, 311
Incarceration and volvulus, 390
following loss of fat in obesity, 24
internal, pain in, 390
mesenteric, of intestine, 390
of gallstones, 395
Incontinence in hysteria, 769
in myxedema, 32
in snake poisoning, 730
of stools in concussion of brain, 712
urinary, 52
in disturbed sensorium, 769
in epileptic attack, 769
occurrence of, 763
true and false, 763
with and without unconsciousness, 769
Increase, daily, in breast-fed and artificially fed children, 51
Incubation period, and antibody formation, 614
and severity of case, 613
definition of, 613
of common infectious diseases, 614
Incubator (couveuse), indications for, 80
Indican, decreased, in pancreas affections, 603
relation of, to indol, 599
Indicanuria, diet in, 604
in chlorosis, 602
in constipation and diarrhea, 599
in diffuse peritonitis, 600

Indicanuria in fever, 601
in gastric ulcer, 601
in inanition, 602
in infants, 600
in infectious diseases, 601
in intestinal hemorrhage, 601
in intestinal stenosis, 400
in kidney affections, 602
in mental diseases, 603
in nervous and mental diseases, 602
in putrid infections outside intestines, 601
in stenosis of small intestines, 600
in stomach diseases, 601
in suppurative processes, 601
in tuberculosis of children, 601
in typhoid fever, significance of, 601
influence of intestinal flora on, 600
therapeutic considerations in, 604
Indigouria, true, 602
Indoxyl formation, organ of, 603
Indoxyluria, experimental, by brain puncture, 602
Induration, brown, of organs, 491
Infancy, calorie requirement in, 34
metabolism in, 34
Infant, development of, 51
food, caloricity of, 35
height of, 48
weight of, 48
Infarct, hemorrhagic, following pulmonary embolism, 211
Infection, and fever, 54
course of, 615
danger of, in premature children, 47
endogenous, of Escherich, 38
influence of, on secretions, 618
intestinal, relation of, to food, 489
local reaction in, 616
mixed and secondary, 619
secondary, 616
septic, collapse temperature in, 81
severe, general, 613
symbiosis of bacteria in, 619
Infectious diseases, 613
acetonuria in, 591
afebrile course of, in debility, 81
factors determining, 615
fatty degeneration of heart in, treatment of, 144
general symptoms of, 617
general treatment of, 621
headache in, 682
heart in, 167
indicanuria in, 601
involvement of nervous system in, 618
jaundice in, 425
local effect of, 616
resistance in obesity against, 25
specific therapy of, 622
subnormal temperature in, 82
tetany in, 654
toxicity of urine in, 617
vertigo in, 750
waxy degeneration in, 253
Influenza, antipyrin in, 65
bradycardia after, 93
Influenza, bronchitis in, hemoptysis in, 512
capillary bronchitis following, 207
cardialgia following, 436
heart in, 177
in obesity, 23
jaundice in, 428
joint affections in, 313
mixed infection with, 273
retropharyngeal abscess following, 323
stomatitis in, 306
trismus in, 313
Ingestion, disturbances of, 303
disturbed, by laryngeal affections, 332
hindered, in carcinoma of tongue, 311
in epidemic parotitis, 309
in luxation of jaw, 312
in mercurial stomatitis, 306
in tetanus of the new-born, 304
Insolation, cerebral hyperemia in, 700
Insomnia, 736, see also Sleeplessness
Insurance, obesity a cause for exclusion from, 25
Integument, discoloration of, in cachexia, 6
Intelligence, diminished, in hereditary syphilis, 52
Intercostal neuralgia, greater frequency of, on left side, 254
Internal secretions, autointoxication from disturbances of, 663
Intestinal atony in chlorosis, 602
Intestinal catarrh, chronic, constipation in, 382
due to venous stasis, 360
in arsenic and sublimate intoxication, 360
stool findings in, 359
symptoms of, 359
Intestinal changes in atrophy, 44
Intestinal colic, 437
Intestinal digestion, disturbed, meat particles in stools in, 475
Intestinal diseases, acetonuria in, 594
vomiting in, 288
Intestinal disinfection, 467
Intestinal disorders of infants, acid intoxication in, 598
Intestinal epithelial cells in stools, 478
Intestinal hemorrhage, fall in temperature in, 506
in benign and malignant tumors, 508, 509
in colitis of infants, 507
in intestinal ulcer, 508
in intussusception, 505
pathogenesis of, 505
Intestinal hyperemia, venous, local, constipation in, 384
Intestinal obstruction, 394
acute and chronic, 387
diagnosis of location of, 399
Intestinal occlusion, 387
Intestinal paralysis in peritonitis, 397
Intestinal parasites, palpitation of heart in, 149
Intestinal perforation in typhoid fever, 4
Intestinal putrefaction, and reaction of stools, 481
aromatic substances in urine in, 599
in catarrhal jaundice, 408
in constipation and diarrhea, 599

Intestinal putrefaction influence of bacterial flora on, 600
product of, 599
urobilinuria in, 611
Intestinal reposition, starch in the stools in disturbance of, 475
Intestinal stenosis, chronic, 387
form of stools in, 472
indicanuria in, 400
oliguria in, 400
Intestinal stricture, 387
Intestinal thrombosis, and embolism, symptoms of, 398
ileus in, 398
Intestinal ulcers, causing melena, 508
in erysipelas, 508
in leukemia, 508
in septicemia, 508
in smallpox, 508
stool findings in, 479
Intestines, atony of, 381
cicatricial strictures of, 396
compression of, 394
diseases of, 358
parts of, in stools, 393
tumors of, 383
Intoxications, causing albuminuria, 576
general pathogenesis and symptomatology of, 714
headache in, 681
heart in, 189
leading to jaundice, 419
to loss of consciousness, 713
subnormal temperature in, 82
vertigo in, 749
Intrathoracic nerves, injury of, 250
Intubation, in laryngeal diphtheria, 198, 626
in laryngeal stenosis, indication for, 197
in paralysis of posticus nerve, 664
ingestion in, 337
Intussusception, chronic, 394
produced by faradization, 376
treatment of, 393
Invagination, agonal, 392
in children, 392
in intestinal sarcoma, 383
intestinal, spontaneous recovery in, 393
tenesmus in, 458
paralytic and spasmodic forms of, 392
pathogenetic factors of, 393
Iodoform intoxication, symptoms of, 725
Iodophil bacteria and carbohydrate absorption, 489
Irritation, cerebral, in air embolism, 87
Itching in jaundice, 405
treatment of, 411

Jactitation in ileus, 397
Jaundice, 59, see also Icterus
acathectic, 403
acid stools in, 476
and methemoglobinemia, 420
and prognosis in phosphorus intoxication, 720
aromatic substances in the urine in, 604
bradycardia in, 405
by obstruction through gallstones, 409
Jaundice, by parapedesis and by stasis, 404
casts in, 583
catarrhal, diet in, 408
duration of, 407
epidemic of, 422
epigastric pain in, 422
in pregnancy, 430
intestinal putrefaction in, 408
pathogenesis of, 407
prognosis of, 407
protein decomposition of, 406
symptomatology of, 406
treatment of, 407
caused by foreign bodies, 409
clinical symptoms of, 405
congenital, 412
constipation in, 405
contraindication for fats in diet in, 487
definition of, 402
diagnosis of, 402
due to lowered pressure, 416, 419
during menstruation, 430
effect of, on the intestines, 405
epidemic, symptomatology of, 422
family, 412
fat resorption in, 405
following angina pectoris, 449
following blood extravasation, 421
following snake bites, 421
following tonsillitis, 423
forms of, 406
from aneurysm of hepatic artery, 413
from emotion, 417
from fright, 417
from parenchymatous affections of the liver, 414
from tumors, 412
hemolytic, 412
hepatogenous and hematogenous, 402
forms of, 406
hyalin casts in, 404
"hysterical," 417
in acid (mineral) poisoning, 403
in acute yellow atrophy, 403
in alcohol intoxication, 403
in arsenic posioning, 403
in arseniuretted hydrogen intoxication, 722
in Buhl's disease, 529
in chloroform poisoning, 403
in cholangitis suppurativa, 423
in cholelithiasis, 449
in cholemic coma, 735
in diseases of the gall-bladder, 424
in epidemic diseases, 403
in exanthematic typhoid, 425
in general amyloidosis, 558
in hemoglobinemia, 421
in inanition, 430
in infectious diseases, 404, 425
in influenza, 428
in intoxications, 419
in leadpoisoning, 404, 420
in liver abscess, 414
in liver cirrhosis, 414
in neoplasms of gall-bladder, 412
in pancreas stones, 449

Jaundice in phosphorus intoxication, 403
in pneumonia, 424, 426
in pregnancy, 414, 430
in primary syphilis, 429
in recurrent fever, 425
in scarlet fever, 427
in septicemia, 427
in sepsis of the new-born, 428
in snake bites, 403
in stenosis of portal vein, 417
in tertiary syphilis, 429
in tuberculin reaction, 420
in tumors obstructing bile ducts, 413
in typhoid fever, significance of, 425
in ulcerative endocarditis, 428
in venous stasis, 416
in Weil's disease, 423
in Winckel's disease, 421, 529
in yellow fever, 403. 428
increase of ethereal sulphuric acids in, 604
indogenous, 419
infectious and epidemic, 422
itching in, 405
latent period of, 405
mechanical, 403
milk in, 404
nervous symptoms of, 405
neutral fat, fatty soaps and crystals in stools in, 476
of bacterial origin, 404
of mother, effect of, on child, 404
of the new-born, and umbilical sepsis, 428
differential diagnosis of, 418
due to hereditary syphilis, 429
frequency of, 418
pathogenesis of, 418, 419
relation of intensity of, to body weight, 418
on exposure to cold, 406
pain in the liver in, 405
pancreatic, 413
postmortem, 428
postoperative, 430
school epidemics of, 422
stools in, 403
sweat in, 404
theories of origin of, 403
through ascarides and distoma, 409
through biliary obstruction, 413
through chloroform and ether, 420
through echinococcus, 413
through hemolytic poisons, 419
through insufficiency of liver cells, 404
through mushroom poisoning, 420
through polycholia, 419
toxic hemorrhage in, 493
urine in, 403, 404
various forms of, 406
war epidemics of, 423
with urobilinuria, 611
Jaws, ankylosis of, due to tumors, 312
in rheumatism, 312
closure of, due to cicatrices in burns, 313
due to fracture, to luxation, 312
due to sensory nerve irritation, 313
due to tumors, 312
following apoplexy, 313
Jaws, following extraction of tooth, 313
closure of, in bulbar paralysis, 312
in cancer of the tongue, 313
in carious teeth, 313
in difficult dentition, 313
in erysipelas, 313
in influenza, 313
in lymphadenitis, 313
in meningitis, 313
in parotitis epidemica, 309
in peritonsillar abscess, 316
in phlegmons, 313
in tetanus neonatorum, 304
in trigeminal neuralgia, 313
in tumor in the pons, 313
muscular in dermatomyositis and trichinosis, 313
in strychnin poisoning, 313
in tetanus infection, 313
nervous, in epilepsy, 313
in trigeminus affection, 313
spastic, in chorea, hysteria, tetany, 313
through articular diseases, 312
diseases of, effect of, on mastication, 312
Jejunal diarrhea, carbohydrate and fat dyspepsia as, 487
stools in, 478
Joint affections in influenza, 313
in peliosis rheumatica, 520
Joints, swelling of, in purpura abdominalis, 521

Keller's modification of Liebig's soup, 486
Kephir, composition of, 15
value of, 15
Kidney, abscess of, hematuria in, 517
symptoms of, 453
affections of, heart in, 166
indicanuria in, 602
amyloid, diagnostic difficulties in, 579
and heart, relation of insufficiency of, 577
angioneurosis of, 516
antitoxic function of, 643
carcinoma of, in childhood, 517
congested contracted, pathogenesis of, 577
contracted, albuminuria in, 580
following chronic alcoholism, 24
gallop rhythm in, 106
in children, 564
in mercury intoxication, 721
treatment of circulatory disorders in, 167
without albumin excretion, 580
diseases of, dyspnea in, 224
engorged, edema in, 553
following obesity, 24
function of, in icterus gravis, 410
gouty, cardiac hypertrophy in, 167
granular, digitalis in, 132
heart in, 164
hemorrhagic infarct of, 517
in arteriosclerosis, 151
in cardiac insufficiency, 128
infarct, pain in, 451
inflammatory, affections of, 451
irritation of, through turpentine, 275
lead, cardiac hypertrophy in, 167
movable, and pregnancy, 453

Kidney, movable, following obesity, 24
incarcerated, simulating ileus, 397
incarceration of, 453
pain in, 452
pain in, 451
in cystitis, 454
in inflammation of urinary passages, 454
sarcoma of, in children, 517
tuberculosis of, hematuria in, 517
tumor of, hematuria in, 517
in childhood, 517
pain in, 453
Kola nut, 139
Koumiss, value of, in overfeeding, 15
Kussmaul's respiration and acidosis, 225
Kyphoscoliosis and height, 8

Labor, injuries of the child during, 525
Lactagogues, unreliability of, 41
Lactic acid in the blood on carbon dioxid poisoning, 598
in the stomach contents, 351
in the stools, 483
test for, in gastric juice, 348
Lactic acid bacilli against constipation, 379
Lactosuria in pregnancy, 589
Laryngeal crisis, cough in, 261
of tabes, 201
diphtheria, 198
paralysis, 202
spasm, occurrence of, 650
tonic, 650
treatment of, 202
stenosis, treatment of, 197
Laryngectomy, feeding in, 336
Laryngitis, chronic subglottic, 198
cough in, 260
croupous, cough in, 262
dyspnea in, 196
hypertrophic submucous, 198
of children, 196, 197
phlegmonous, of childhood, 197
Laryngospasm and meteorism, 467
as tumor symptom, 201
caused by pressure of tracheobronchial glands, 201
in children, relation of, to tetany, 651
in epilepsy, tetanus, tetany, 201
in hydrocephalus, 706
in tabes dorsalis laryngeal crises, 201
loss of consciousness in, 712
symptom of tetany, 201
Laryngospastic attacks of adults, 201
Laryngostenotic attack, picture of, 196
Larynx, carcinoma of, 334
diseases of, causing dysphagia, 332
foreign bodies in, 200
paralysis of, 664
syphilis of, 334
dyspnea in, 199
tuberculosis of, 333
dyspnea in, 199
treatment of, 199
Lassitude, symptom of fever, 57
Lead colic, pulse in, 93
symptomatology of, 445
Lead colic, symptoms and treatment of, 722
gout, 723
in red pepper, 722
in rivers, sand, and clay, 722
in tin cans, 722
intoxication from, acute, onset and symptoms of, 722
arteriosclerosis following, 151
chronic form of, 722
expiratory dyspnea in, 715
predisposing to cerebral hemorrhage, 691
vagus in, 185
ointments and plasters, danger of, 722
poisoning from, and angina pectoris, 239
bradycardia in, 92
cachexia in, 7
cathartics indicated in, 715
constipation in, 386
decreased excretion of uric acid in, 609
hematoporphyrinuria in, 583
in children, 722
jaundice in, 404, 420
paralysis and reaction of degeneration in, 659
stomatitis, 306
Leeches, use of, 647
Leiter's cooling apparatus in pericarditis, 146
Lenhartz treatment of gastric ulcer, 502
Lepra, hemoptysis in, 513
Lethargy in hysteria, 710
Leube's treatment of gastric ulcer, 502
Leucin and tyrosin in the urine, occurrence of, 606
Leukanemia, 541
Leukemia, acute, gangrenous stomatitis in, 310
lymphatic, 539
aplastic, 540
chronic lymphatic, 540
diagnosis of, 540
dyspnea in, 223
edema in, 553
heart in, 179
hemorrhages in, 492
in childhood, 541
increased uric acid excretion in, 608
influence of X-rays and, 541
intestinal ulcers in, 508
mixed cell, 540
myelogenous, 540
pallor in, 1
retinal and choroid hemorrhages in, 529
tongue in infiltrations of, 310
with normal number of leukocytes, 540
Leukocytes, destruction of, 61
Leukocytosis, artificially produced, 548
following muscular exertion, 545
forms of, 545
in anemia, 549
in chickenpox, 547
in death agony, 545
in erysipelas, 548
in exanthematic typhoid, 548
in infancy, 545
in malignant tumors, 549
in osteomyelitis, 548
in paranephritic abscess, 547

Leukocytosis in pelvic affections, 547
in pelvic tumors, 548
in perityphlitis, 546
in pregnant women, 545
in purulent meningitis, 546
in relapsing fever, 548
in rheumatic polyarthritis, 547
in scarlet fever, 547
in septicemia, 547
in smallpox, 547
of digestion, 545
of the new-born, 545
pathological, occurrence of, 545
polynuclear, rôle of eosinophiles in, 545
produced by hetol, 633
under normal conditions, 544
value of, for the course of disease, 546
Leukopenia in malaria, 548
in Malta fever, 548
in measles, 547
in typhoid fever, 548
Levulosuria, 589
Liebig's soup, indications for, 485
preparation of, 485
Lips, fissure of, in measles, 319
in scarlet fever, 319
specific affections of, 311
Liquids, as diuretics, 72
restriction of, in cardiac lesions, 122
Liver, abscess of, and cholangitis, 424
in amebic dysentery, 488
in dysentery 446
in typhoid fever, 446
jaundice in, 414
myocardial changes in, 164
pain in, 446
puncture of, 446
acute yellow atrophy of, heart in, 164
jaundice in, 415
leucin and tyrosin in the urine in, 585
urinary amino acids in, 606
without jaundice, 415
affections of, acetonuria in, 595
heart in, 164
hematoporphyrinuria in, 583
vomiting in, 294
amyloid, secretion of bile in, 415
antitoxic function of, 642
atrophy of, stools in, 415
cancer of heart in, 165
cirrhosis of, constipation in, 385
hemorrhages from esophagus in, 329
hydrops in, 570
increased uric acid excretion in, 609
jaundice in, 414
pain in, 447
congestion of, in cardiac insufficiency of diphtheria, 169
crises, in tabes dorsalis, 449
diseases of, urobilinuria in, 612
engorgement of, in obesity, 22
enlargement of, in cardiac stasis, 126
in paroxysmal tachycardia, 149
fatty degeneration of, following chloroform anesthesia, 724
in tuberculosis, 141
Liver, function of, alimentary glycosuria sign of disturbance of, 587
disturbance of, leading to autointoxication, 642
hyperemia of, 416
pain in, 447
in cardiac insufficiency, 129
in emphysema, 160
in recurrent fever, 425
insufficiency of, increased ammonia elimination in, 596
indoxyluria in, 603
occurrence of, 643
relation of, to cholelithiasis, 447
urobilin formation in, 611
neuralgia of, 449
organ for neutralizing poisons, 714
pain in, 446
in bronchial asthma, 446
occurrence of, 447
tumors of, causing jaundice, 413
venous pulsation of, 128
Lividity, in freezing, 79
Loss of consciousness in brain abscess, 701
Lumbar puncture, danger of, in tumors of posterior occipital fossa, 703
in enuresis, 765
in headache, 678, 679
in hydrocephalus, 706
in infants, 702
in Ménière's vertigo, 749
in nephritic headache, 687
in syphilitic headache, 685
in uremia of scarlet fever nephritis, 731
technic of, 702
value of, 704
Lungs, abscess of, dyspnea in, 191
through foreign body, 248
diseases of, deficient secretion in, 273
respiration in relation to fever in, 59
excursions of, in obesity, 21
hyperemia of, pathogenesis of, 511
overexpansion of, through cough, 288
position of, in paralysis of diaphragm, 662
Lye, cauterization by, 332
intoxications with, 718
Lymph glands, sensitive, after vaccination, 640
sublingual, enlargement of, in ulcerative angina, 307
swelling of, in retropharyngeal abscess, 323
Lymphadenia ossium, sternal pain in, 251
Lymphadenitis, hypertrophic, dyspnea in, 195
Lymphocytosis, following tuberculin injection, 546
occurrence of, 546
relative, in typhoid fever, 548
Lymphoma, causing tracheal stenosis, 204
Lymphosarcoma, constipation in, 383
of neck, deglutition in, 322
Lysis, 57

Malaria, acetonuria in, 591
adynamic form of, 83
cachexia in, 7
chronic, skin in, 426
diarrhea in, 363

Malaria, dyspnea in, 221
edema in, 558
enteralgia in, 444
fever in, 56
headache in, 683
heart in, 176
hemoglobinuria in, 549
hemoptysis in, 513
hydrotherapy in, 69
jaundice in, 404, 426
laceration of spleen in, 450
leading to bronchial asthma, 221
leukopenia and leukocytosis in, 548
nephritis in, 563
nervous gastralgia in, 436
neuralgia in, 251, 665
pernicious subnormal temperature in, 83
quinin in, action of, 64
simulating eclamptic seizure, 711
Male fern extract, jaundice following use of, 420
Malnutrition in phthisis, 9
results of, 8
Malta fever, leukopenia in, 548
Mammary glands, pain in, 255
Mammilla, rhagades of, pain in, 256
Mania, relation of, to cardiac affections, 129
Mannaberg, symptom of, 164
Marmorek's streptococcal serum, 634
Marshall Hall's disease, 706, see Hydrocephaloid
Massage in constipation, 376
of heart, in compensated heart lesions, 123
Mast cure, indications and contraindications for, 10
of v Noorden, 17
stock of fat in, 13
Mastfettherz, 141
Mastication, hindered, 305
in angina ulcerativa, 308
in affections of the jaw, 312
in mercurial stomatitis, 306
Mastodynia, 255
Masturbation, constipation in, 372
in sopor of specific meningitis, 704
incontinence in, 52
Measles, capillary bronchitis in, 206
croupy cough in, 262
desquamation in, 6
diazo-reaction in, 606
œsophagitis in, 328
heart in, 173
hemorrhagic rash in, 6
hydrotherapy in, 69
laryngitis phlegmonosa in, 197
leukopenia in, 547
temperature in, 71
Meat, distaste for, in ammonemia, 598
feeding with, advisability of, 10
in jaundice, 408
poisoning with, 729
Mechanotherapy, in cardiac pain, 240
in compensated heart lesions, 123
Meckel's diverticulum, causing strangulation, 391
incarcerated, simulating ileus, 397
Meconium, mucus in, 477
Mediastinitis, chronic, thoracocentesis in, 213
following retropharyngeal abscess, 323
indurative, pulse in, 96
Mediastinopericarditis, puncture of pleural exudate in, 562
Mediastinum, affections of, pain in, 246, 247
Medulla oblongata, affections of, and deglutition, 335
Melancholia following iodoform intoxication, 725
Melancholia agitata, relation of, to cardiac affection, 129
Melanin in the urine in melanosarcoma, 612
Melanosis, arsenical, 3
of skin, in chronic arsenic intoxication, 722
Melanuria, significance of, 612
Melena, causes of, 479
in Buhl's disease, 529
Melena neonatorum, gelatin in, 497
intestinal ulcers in, 528
pathogenetic factors of, 528
relation of, to sepsis and syphilis, 528
symptoms of, 527
true and false, 293
vomiting in, 293
Melena vera and spuria, 527
Melituria, forms of, beside glycosuria, 589
Ménière's disease, diagnosis and etiology of, 748
sensorium in, 710
symptoms of, 710
Ménière's vertigo, symptom-complex of, 747
Meningeal apoplexy, coma in, 707
Meningitis, basilar, fall of temperature in, 83
tubercular, diazo-reaction in, 607
bradycardia and tachycardia in, 184
cerebrospinal, diagnosis of, by lumbar puncture, 639
indicanuria in, 603
constipation in, 386
forms of, 706
heart action in, 91
pathogenesis of, 706
peristalsis in, 386
pulse in, 184
purulent, leukocytosis in, 546
respiration in, 226
serosa, headache in, 679
syphilitic, basal, 704
persistent insomnia, 737
tachycardia in, 91
trismus in, 313
tubercular, apoplectic onset of, 707
behavior of children in, 297
bradycardia in, 182
cerebrospinal liquid in, 703
erythema in, 2
postmortal rise of temperature in, 58
trauma and, 297
vomiting in, 297
Meningoencephalitis, syphilitic, symptom-complex in, 704
Menopause, hemorrhages in, 24
Menstruation and enteralgia, 439
and gastralgia, 437
disturbances of, and impaired hearing, 530
of nursing mother, effect of, on infant, 370
vicarious, 493

Mental disturbances in chronic arsenic intoxication, 722
emotions and state of nutrition, 18
Mentality in disturbed compensation of heart, 126
Mercury poisoning, cachexia in, 7
due to abuse of calomel, 306
prophylaxis of, 306
symptomatology of, 721
Mesenteric artery, embolism of, melena in, 505
Metabolism, calorie requirement of premature children, 34
Camerer's law of, 36
decreased in dyspnea, 193
diseases of, angina pectoris in, 240
in cardiac insufficiency, 126
in children, 34
in fever, 59, 73
in hyperthyroidism, 17
in marasmus, 7
in old age, 7
in psychoses, 18
increase of, due to addition of proteins, 11
of inanition, 7
Voit's law of, 34
Metal poisoning, color changes in, 3
Metastasis formation, 651
Meteorism, absence of, in strangulation, 388
aiding in topical diagnosis of ileus, 399
and dyspepsia in infants, 467
and milk ingestion, 466
associated with cyanosis, 465
definition and diagnosis of, 463
due to decreased resorption of gas, 464
due to diffusion of carbon dioxid, 465
due to increased production of gas, 464
effect of, on circulation, 90
effect of, on heart, 162
following intake of fermented beverages, 465
in constipation, 385, 465
in dyspeptic infants, 39
in ileus, 388
in infants, 467
in infections, 466
in intestinal atony, 381
in intestinal obstruction, 388
in intestinal tuberculosis, 465
in milk dyspepsia, 40
local, in acute intestinal occlusion, 388
in volvulus, 391
occurrence and significance of, 465
of the large and small intestines, 463
on paralysis of abdominal muscles, 468
pathogenesis of, 464
relation of, to eclamptic attacks, 467
subjective sensations of, 465
through aerophagia, 465
treatment of, 466
Methemoglobin, poisons producing, 420
Methemoglobinemia in anilin poisoning, 65
Methemoglobinuria and jaundice, 420
in potassium chlorate poisoning, 719
Metrorrhagia in menopause, 519
Microcephalia, symptoms of, 32
Micromelia, chondrodystrophy in, 32
Micturition, absence of desire for, in tumors of spinal cord, 768
disorders of, in urinary calculus, 773
disturbances in, 755
disturbed continuity of, 758
precipitate, 758
retardation of, 757
in multiple sclerosis, 768
Migraine, angioparalytic form of, 189
astigmatism in, 675
aura in, 674
differential diagnosis of, 674
eye symptoms in, 675
in diabetes mellitus, 688
in progressive paralysis, 686
of advanced age, 674
of school children, 676
pain in, 673
pathogenetic theories of, 673
pupils in, 673
relation of, to glaucoma, 675
sequelæ to, 674
sympathetic tonic form of, 188
heart in, 188
symptomatic, occurrence of, 676
symptoms of, 673
treatment of, 675
Milk, antitoxin of diphtheria in, 622
as food in fever, 76
cause of antiputrid action of, 603
concentration of, 35
in intestinal disorders, 36
decomposition of, through overheating, 43
diet disturbances (Milchnähr-schaden), fat dyspepsia in, 476
disturbances, in artificial feeding, 38
in breast-fed children, 40
prognosis of, 39
treatment of, 39
diuretic action of, in heart failure, 131
mother's, intolerance for, 482
overheated, cause of dyspepsia, 42
raw, of animals, as infants' food, 36
sterilized, effect of, on intestinal putrefaction, 600
sugar in protein dyspepsia, 485
whey mixture of Monti, 484
Mineral waters in obesity, 29
Mitral insufficiency, 119
digitalis in, 134
following scarlet fever, 171
lesions, reduplication of second sound in, 105
second pulmonic sound in, 104
regurgitation, dicrotism in, 99
stenosis, bradycardia in, 93
gallop rythm in, 106
valve, lesions of, disturbed compensation in, 126
Mixed infection and secondary infection, 619
spreading of, in the organism, 620
Moeller-Barlow disease, and faulty feeding, 43
bone changes in, 523
occurrence of, 523
symptomatology of, 523
Mongolism, abdomen in, 468

Morbus maculosus Werlhoffii, internal hemorrhages in, 520
interstitial nephritis in, 521
Morphin as expectorant, 245
high sensitiveness of children to, 728
intoxication with, 727
symptoms on sudden abstinence of habitual eaters of, 723
Moser's serum in scarlatinal nephritis, 172
in scarlet angina, 319
in scarlet fever, 634
Moskowicz test, 111
Motor irritation, symptoms of, 648
Mountain climate, in nervous palpitation of heart, 149
indication for, in compensated heart lesion, 122
Mountain climbing, loss of fat in, 13
palpitation in, 148
Mouth, changes in, hindering ingestion, 303
closure of, in luxation of jaw, 312
mucosa of, in phosphorus necrosis, 306
open, in luxation of the capitulum mandibulæ, 312
Movements, forced, in brain affections, 743
Mucin in the urine, 581
Mucous membranes, inspection of, in chlorosis, 20
Mucus in stools, 477
bile tinged, 477
cloudiness of, 479
in intestinal catarrh, 359
of enteritis membranacea, 383
in vomited matter, 344
Multiple sclerosis, vertigo, 754
Murmurs, 106
accidental, 106
in children, 107
anemic, in children, 108
functional, 106
production of, 107
venous, 106
Muscle, tone of, in dyspeptic infants, 39
waxy degeneration of, 253
work of, in obesity, 28
Muscular exercise, during mast cure, 13
Mushroom poisons, jaundice in, 420
Mustard water packs, technic of, 207
Mydriasis in atropin poisoning, 367
in cerebral anemia, 697
Myelitis, cervical, trachycardia in, 185
Myocardite segmentaire, 145
Myocarditis, acute interstitial, occurrence of, 173
congenital, 570
constipation in, 385
digalen in, 146
digitalis in, 132
embryocardia in, 105
in diphtheria, 145, 168
prognosis of, 169
in gonorrhea, 145
in obesity, 178
in rheumatic polyarthritis, 145
in scarlet fever, 145, 171
in small-pox, 145
Myocarditis in typhoid fever, 145
indurative, 145
interstitial, in typhoid fever, 174
syphilitic, 145
treatment of, 145
typhosa, pulse in, 175
Myocardium, changes of, in liver abscess, 164
degeneration of, in emphysema, 160
ischemia of, 142
Myoma of uterus, cachexia in, 7
Myomalacia cordis following atresia of coronary artery, 88
Myositis ossificans multiplex progressiva, pain in, 254
syphilitic, causing difficulty on swallowing, 322
Myxedema, abdomen in, 32
age in, 31
face in, 31
mental functions in, 32
prognosis of, 32
symptoms of, 31
temperature in, 82
treatment of, 32

Nails, curved, of clubbed fingers, 117
Nauheim bath, in heart affections, 122, 124
indications and contraindications for, 123
treatment, in compensated heart lesions, 126
Nausea, in cerebral anemia, 697
in migraine, 673
in sea-sickness, 751
induced by strophantus, 136
on irritation of vestibular nerve, 741
on lumbar puncture, 703
produced through vertigo, 742
Neck, stiff position of, in retropharyngeal abscess, 323
stiffness of, in hysteric pseudomeningitis, 680
in rheumatic myositis, 672
in tetanus, 652
Necrotic degeneration, in septic diphtheria, 318
Neoplasms, intestinal, pus in stools in, 479
Nephritis, 559, see also Renal insufficiency
acute, pain in, 451
treatment of, 560
and stasis, 557
chronic, accentuation of second aortic in, 106
interstitial, anacrotic pulse in, 99
treatment of, 563
parenchymatous, treatment of hydrops in, 563
pendular rhythm in, 105
pulsus tardus in, 97
tension of pulse in, 97
congenital, 570
diet in, 559
edema in, 552
following carbolic acid poisoning, 725
following potassium chlorate poisoning, 719
headache in, 687
hemorrhagic, 515
in childhood, 516
in acid poisoning, 717
in children, forms of, and treatment, 564

Nephritis in children, pathogenesis of, 564
in diphtheria, 623
in malaria, 563
in sublimate intoxication, 721
in Weil's disease, 423
increased body weight in, 578
ingestion of raw eggs affecting albuminuria in, 578
of infants, without albuminuria, 580
of pregnancy, effect of, on the child, 45
of scarlet fever, heart in, 171
parenchymatous hematuria in, 515
postscarlatinal, 6
quantity of albumin excreted in various forms of, 578
relation of globulin to albumin in, 578
retention of chlorids in, 578
scarlatinal, hematuria in, 516
scarlatinosa, treatment of, 172, 173
sine albuminuria, 578
sparing therapy in, 559
toxic, hematuria in, 516
unilateral renal hemorrhage in, 516
use of proteins in dietetic treatment of, 579
without albumin and casts in hereditary syphilis, 581
Nephrolithiasis, hematuria in, 516
pain in, 451
pus and erythrocytes in the urine in, 582
simulating ileus, 397
treatment of, 452
Nephrolysis in chronic interstitial nephritis, 564
Nerves, injury of, 250
Nervous affections and angina pectoris, 239
diseases, bladder functions in, 767
causing dysphagia, 334
circulatory disorders in, 181
indicanuria in, 602
leading to hemorrhage, 530
respiratory disorders in, 226
irritation, 648
symptoms and intestinal autointoxication, 645
in fever, 59
system, and body temperature, 56
and glycosuria, 588
in febrile conditions of childhood, 71
postinfectious affections of, 618
Neuralgia, cervicobrachial, in articular rheumatism, 252
definition and diagnosis of, 665
in malaria, 251, 665
intercostal, due to aortic aneurysm, 243
in mediastinal processes, 247
in pulmonary tuberculosis, 246
in spinal affections, 254
occurrence of, 254,–255
Valleix points in, 255
intervertebral, 252
of bladder, genitals and rectum, 462
of phrenic nerve, 280
of the rectum, 462
pathogenesis of, 665
supraorbital, in influenza, 684
in sinus phlebitis, 673
Neuralgic pains, 251
Neurasthenia and intestinal atony, 602
and intestinal autointoxication, 645
cerebralis, 746
complaints about the heart in, 119
dietetic therapy in, 17, 18
gastric atony in, 346
headache in, 679, 682
heart in, 188
indicanuria in, 602
sexual, diarrhea in, 363
oxaluria and phosphaturia in, 585
tachycardia in, 92
vasomotor, of the heart, 119
vomiting in, 299
Neuritis and incontinence, 52
in mercury intoxication, 721
of bulbar nerves, deglutition in, 335
Neurones, relation of, to angina pectoris, 239
Neurosis, intestinal, secretory, 383
of stomach, malnutrition in, 9
secretory 354
treatment of, 355
traumatic, vertigo in, 747
vertigo in, 746
New-born, respiration of, 192
Night sweats, in early and progressed tuberculosis, 4
significance of, in phthisis, 4
treatment of, 4, 5
Night terror in adenoid vegetations, 195
Nitric acid poisoning, symptoms of, 717
Nitrogen, elimination of, in Basedow's disease, 17
exchange, rise in scrofula, 28
Nodding spasm, 656
nystagmus in, 656
occurrence of, 656
of children, 752
Noma, digestive disorders in, 309
gangrenous stomatitis in measles, 308
"Nonnensausen," 107
Normal serum as hemostatic, 498
Nostrils, vibration of, sign of dyspnea, 209
Nourishment, artificial, in trismus, 314
Nuclein bodies and uric acid, 607
Nucleoalbumin in the urine, 581
Nucleoalbuminuria following injection of heterogenous serum, 581
Nursing, impossible in tetanus neonati, 653
technic of, in infants suffering from milk dyspepsia, 40
Nutrition, after first year of life; 36
anomalies of, 6
disorders of, due to changes in oral cavity, 305, 310
disturbances of, due to overheated milk, 42
in cardiac insufficiency, 126
in infancy, 38
in leukemia, 310
in scarlet fever, 319
extrabuccal, 337
febrile, technic of, 75
importance of ample, in Graves' disease, in hysteria, 10
in congenital debility, 80

Nutrition, poor, in light eaters, 9
state of, and heart disease, 23
subcutaneous mode of, 341
Nycturia in cardiac weakness, 117
Nystagmus as symptom of vertigo, 741
by reflex action, 753
in cerebellar vertigo, 742
in defects of vision, 752
in diseases of central nervous system, 753
in multiple sclerosis, 753
in nodding spasm, 656
occurrence of, 752
ocular and vestibular, 572
of miners, 752
on fracture of base of skull, 754
produced by galvanic current, 741
vestibular production of, 753

Obesity, alimentary glycosuria in, 26
and emphysema, 20
and functional incapacity of heart, 20
and heart disease, 22
anemic, 21
at climacteric period, 26
Banting's cure for, 143
calorie requirement in, 27
calorific value of foods in, 29, 30
climate indicated in, 29
complications of, 20
decreased power of decomposition in, 26
definition of, 19
dehydration treatment in, 27
diagnosis of, 25
dietetic regimen in, 29, 30
difficulty of diagnosis of carcinoma in, 23
due to overfeeding, 25
due to retardation of metabolism, 25
dysmenorrhea in, 24
dyspnea in, 21
Ebstein's cure in, 143
exercise in, 27
heart in, 178
hydrotherapeutics in, 28
massage in, 28
metabolism of, 25
mineral-water in, 29
Oertel's cure in, 143
v. Noorden's dietary in, 30
produced by castration, 26
prognosis of, 25
protein deposit in, 144
"relative" (v. Noorden), 20
respiratory organs in, 23
severe, circulatory disorders in, 20
clinical picture of, 20
subalimentation in, 27
tendency of races to, 26
terrain cure in, 28
thyroid extract in, 29
treatment of, 26
diet in, 27
weeping eczema of breasts in, 24
Obstruction, intestinal, 368, 394
location of, 399
through ascarides, 395
Occlusion, intestinal, and peritonitis, 385
Occult hemorrhage, gastric, 501
Oertel's terrain cure in compensated heart lesions, 122, 124
treatment for cardiac lesions, 121, 122
in fatty heart, 142
Oil injections, subcutaneous, 342
Oligocythemia, posthemorrhagic, 537
Oliguria, in oxalic acid poisoning, 718
in stenosis of ileojejunum, 400
in uremia, 61
occurrence of, 572
relation of, to edema, 552
Omentum, incarcerated, simulating ileus, 397
Omphalorrhagia, 526
Ophthalmo-reaction in tuberculosis, 632
Opisthotonos in tetanus, 652
Opium, different effect of, on different races, 726
in childhood, dangers of, 726
poisoning by, differential diagnosis of, 727
face in, 2
frequency of, 726
symptoms of, 727
Oppler-Boas bacilli in carcinoma, 353
Oppression, in chest, in cardiac paralysis, 169
in chronic cardiac weakness, 118
in granular kidney, treatment of, 167
in obesity, 178
sense of, in liver affections, 164
Oral affections in hemorrhagic diathesis, 311
cavity, affections of, 311
Organotherapy in anemias, 544
in Basedow's disease, 187
Orthopnea in bronchitis of children, 207
in cardiac weakness, 118
in disturbed compensation, 126
in miliary tuberculosis, 211
in obesity, 22
in pericarditis, 145
in pneumothorax, 216
Ostealgia, thoracic, 251
relation of, to gout, 251
Osteomalacia, castration in, 252
diagnosis of, 33
painful bones in, 252
treatment of, 33
Osteomyelitis, acute, blood picture in, 548
of the jaws, in phosphorus necrosis, 306
Othematoma in progressive paralysis, 531
in the insane, 531
Ovarialgia, incorrectness of term, 440
Ovarian cyst, twisting of pedicle in, 397
Overexcitability in children, 202
to the galvanic current, 655
Overexertion as cause of cardiac dilatation, 140
Overfatigue, acute, heart dulness in, 127
Overfeeding by increasing the fats of diet, 15
cause of flatulent colic in infants, 443
cause of milk dyspepsia, 40
danger of, in phthisical patients, 9
in neurosis, 10
indications for, 14
of children, 34
resistance lowered through, 178
results of, 12
treatment by, in phthisis, Dettweiler's, 15

Overheating, 78
artificial, 61
Oxidation, decreased, in obesity, 26
lessened in freezing, 79
reduced in diphtheria, 55
Oxybutyric acid in carcinomatous coma, 734
in the urine outside of diabetes, 733
relation of, to diabetic coma, 733
Oxygen, consumption of, after castration, 26
in congenital heart lesions, 116
in convalescence, 13
in dyspnea, 190
intravenous infusion of, 221

Pachymeningitis, hypertonic bladder in, 766
internal hemorrhagic, pathogenesis of 707
Packs, wet, in fever, 68
Pain, abdominal, 431
in extraabdominal affections, 431
in follicular angina of children, 431
on percussion, 432
on pressure, 431
at night, in myositis ossificans, 254
colicky, in "darmsteifung," 387
in intestinal occlusion, 289
in milk dyspepsia, 40
cry of, in infants, in tetanus, 304
gastric, in congenital pyloric stenosis, 292
in hypersecretion, 287
in angina epiglottidea, 332
in aortic aneurysm, 153, 243
in arthritis deformans of spinal column, 252
in arms, in angina pectoris, 236
in arteriosclerotic processes, 234
in back, in abdominal aneurysm, 243
in myositis ossificans, 254
in bladder, 756
in bones, in Moeller-Barlow's disease, 523
in bronchiectasis, 248
in bronchiostenosis, 248
in bronchitis, 247
in carcinoma of esophagus, 250
of stomach, 435
of tongue, 310
in chest, 233
classification of, 234
constrained position in, 233
due to badly healed fracture of ribs, 251
in affections of bones, periosteum and joints, 251
in neoplasm of pleura, 245
in pulmonary embolism, 211
prognosis of, 234
in chronic pulmonary tuberculosis, 246
in diaphragm, in hiccough, 649
in neuralgia of phrenic nerve, 280
in duodenal ulcer, 504
in epigastrium, in pericarditis, 242
in esophageal carcinoma, 325
in esophagitis, 325
in esophagus affections, 250
in foreign bodies in bronchi, 248
in gastric ulcer, 434
in glossitis, 309
in heart region, 188
in hemorrhagic infarct of the lung, 242
Pain in herpes zoster, 255
in ileus, character of, 398
relation of, to pressure, 398
in intestinal catarrh, 438
in intestinal tumors, 442
in intestinal ulcers, 438
in kidney, 451
localized in the bladder, 755
in legs, in angina pectoris, 236
in intermittent claudication, 111
in liver, 446
in abscess of, 446
in acute yellow atrophy of, 415
in lung affections, 244
in mammary glands, 255
in musculature of the chest, 252
in neck, in angina pectoris, 236
in neuralgia, 665
in peritoneal affections, 454
in phosphorus necrosis, 306
in pleural adhesions, 245
in pneumonia, 245
in pulmonary calculi (bronchial stones), 248
in rectum, 456
in carcinoma, 396
in rheumatism of abdominal muscles, 440
in right hypochondrium, in chronic cardiac weakness, 118
in shoulders, in angina pectoris, 236
in spleen, 450
in sternum, in lymphadenia ossium, 251
in stomach, 432
in subclavian arteritis, 242
in suppurative periaortitis, 242
in swollen bronchial glands, 249
in tabes, 666
in testicles in angina pectoris, 236
in throat, in diphtheria, 317
in trigeminus region, in angina pectoris, 236
in tubercular stricture of esophagus, 250
in umbilical region, in incarcerated hernia, 390
in urinary retention, 761
in valvular lesions, 235
intensity of, in relation to danger, 233
intestinal, 437
intrathoracic, in pleural affections, 244
lancinating, in tabes, 666
localization of, by the patient, 431
muscular, in dermatomyositis, 253
in pulmonary tuberculosis, 246
on cohabitation, 463
on concussion of body, in stone of bladder, 773
on coughing, in diaphragmatic pleurisy, 244
on deep respiration, causing dyspnea, 191
on defecation, effect of, 374
on deglutition, in laryngeal tuberculosis, 333
in larynx affections, 332
on ingestion, in stomatitis, 305–310
on insertion of diaphragm, in aortic aneurysm, 243
on mastication, 304–314
on pressure on the larynx, 197
on respiration, in trichinosis, 253
on swallowing, in esophagitis, 328
oral, due to syphilis of tonsils, 322

Pain over the heart, 109
pericardial, 241
pleural, in gout, 245
pleuritic, in pneumonia, 210
predicting hemorrhage in tuberculosis, 246
radiating, in angina pectoris, 236
in gastric ulcer, 434
into left shoulder, in movable spleen, 450
into right shoulder, 446
into the abdomen, in pneumonia, 245
into the arms and back, in aortitis, 242
into the arms and shoulder, in pericarditis, 242
into the testicles, in nephrolithiasis, 457
into thigh, in kidney infarct, 451
retrosternal and parasternal, in mediastinitis, 247
in arteriosclerosis, 152
in bronchitis, 247
sacral, in habitual constipation, 373
stenocardiform, in arteriosclerosis of aorta, 241
sudden, abdominal, in invagination, 393
in pulmonary embolism, 242
violent, in embolism of mesenteric artery, 118
in hemorrhagic renal infarct, 517
syncopal, in chest, 243
thoracic, in bronchitis of arthritic patients, 248
in skin affections, 255
traumatic, muscular, 252
umbilical, in abdominal arteriosclerosis, 436
in peritonitis, 454
violent, in chest, in paralysis of the heart, 244
in pneumothorax, 245
Palate, affections of, impairing ingestion, 311
cleft, feeding of children with, 303
influence of, on ingestion, 303
treatment of, 304
Pallor, in acute cardiac weakness, 117
in air embolism, 87
in Bright's disease, 2
in capillary bronchitis, 207
in cardiac paralysis of diphtheria, 169
in cocain intoxication, 729
in diphtheria, 168
in freezing, 79
in hypoplasia of vascular system, 112
in internal hemorrhage, 163
in nervous people, 535
in vasomotor neurasthenia of heart, 120
resulting from vascular spasm, 1
sudden, in convalescence from diphtheria, 2
in myocarditis, 2
in psychical irritation, 2
waxy, in asphyxia of new-born, 227
Palpitation, announcing failure of compensation, 110
apex beat in, 110
during rest, 186
in Addison's disease, 165
in Basedow's disease, 186
in chlorosis, 180
in chronic cardiac weakness, 118
in disturbed compensation of the heart, 126
Palpitation in goiter, 186
in hypertrophy of heart muscle, 141
in liver affections, 164
in mountain climbing, 148
in movable heart, 101
in multiple sclerosis, 185
in obesity, 22, 178
in pernicious anemia, 179
in vasomotor neurasthenia of the heart, 120
of heart, 178
treatment of, 148
on puncture of hydrothorax, 562
Pancreas, affections of, fat-splitting function in, 476
unchanged food particles in stools in, 473
enema, of Leube, 339
modification of, of Dobell, 339
fat necrosis of, 23, 24
cause of hemorrhage, 532
function of, impaired, absence of indicanuria in, 603
hemorrhage in, 24, 531
diagnostic difficulty of, 532
stones, jaundice in, 449
tumor of, compressing duodenum, 394
Paracholia, 404
forms of, 406
Parageusia, occurrence of, 668
Paralysis, acquired, during birth, 664
agitans, symptoms of, 658
and paresis, 659
cardiac, in diphtheria, 168, 169
examination in, by the electric current, 659
general treatment of, 660
general review of, 659
in cerebral apoplexy, 691
in embolism of brain, 695
of deglutition, 334
postdiphtheritic, 624
progressive, following catarrhal jaundice, 405
temperature in, 54
simulated by other conditions, 659
Paranephritic abscess, leukocytosis and, 547
pain in, 453
Parasites causing enteralgia, 439
Paresthesias in vasomotor neurasthenia of the heart, 120
preceding cerebral thrombosis, 696
Parosmia, occurrence of, 667
Parotitis, epidemic, bradycardia in, 93
disturbed nutrition in, 309
headache in, 685
Paroxysmal hemoglobinuria, see Hemoglobinuria
alternating with cyclic albuminuria, 549
tachycardia, definition of, 149
dilatation of heart in, 149
treatment of, 150
vagus in, 150
Pavor nocturnus in adenoid vegetation, 195
Pediatrophy, 36
Pegnin milk, 485
Peliosis rheumatica Schoenleinii, joint affections in, 520
Pellagra, disturbed consciousness in, 730

Peptonuria, enterogenous, 581
hepatogenous, 582
in carcinomatosis, 582
nephrogenous, in phosphorus intoxication, 582
occurrence of, 582
pyogenous, 581
Perforation, intestinal, following obstruction, 387
in fat necrosis, 24
vomiting in, 294
Periaortitis, suppurative, 242
fever in, 243
Pericardial adhesions, systole in, 87
systolic retractions in, 102
effusion, apex beat in, 100
exudate, size of, demonstrable by percussion, 103
synechia, apex beat in, 102
Pericardiotomy, indications for, 147, 146
Pericarditis, adhesive, cardiolysis in, 569
symptom-complex of, 450
attacks of stenocardia in, 238
cardiac disorders in, 146
diet in, 146
difficulty in swallowing in, 242
digitalis in, 146
dyspnea in, 219
heart sounds in, 103
hemorrhagic, 514
orthopnea in, 146
pain in, 241
pulse in, 146
salicylates in, 64
systolic retractions following, 102
treatment of, 146
Pericardium, adherent, 148
and angina pectoris, 238
dyspnea in, 220
concretio, cum corde, 168
diseases of, 146
increased pressure in, and diastole, 86
puncture of, 220
Periencephalitis following acute delirium, 700
Period, cortical, in infant's life, 47
Periostitis in syphilis, 673
of jaws, 312
Peripheral circulation in typhoid fever, 175
Periproctitis, 457
Perisplenitis, pain in, 450
Peristalsis, in acute intestinal anemia, 384
in intestinal obstruction, 399
in meningitis, 386
increased, fatty stools in, 476
violent, in asphyxia, 384
Peritoneal affections, pain in, 454
Peritoneum and pain, 437
irritation of, tachycardia in, 94
Peritonitis, accentuation of second pulmonic sound in, 105
acute, pain in, 454
causing intestinal stricture, 396
chronic exudative, pathogenesis of, 571
constipation in, 385
differentiation of, from ileus, 397
diffuse, indicanuria in, 600
Peritonitis, facies hippocratica in, 5
following pancreatic hemorrhage, 532
following stercoral ulcers, 374
hemorrhagic, occurrence of, 514
pain in, on percussion of abdomen, 432
paralytic ileus in, 397
singultus in, 454
symptomatology of, 385
tubercular, ascites in, 571
constipation in, 385
Perityphlitis, albuminuria in, 577
anuria in, 454
colic in, 441
constipation in, 385
gastric hemorrhage in, 505
importance of leukocytosis in diagnosis of, 546
indication for surgical intervention in, 547
Pernicious anemia, action of X-rays in, 541
Perspiration, insensible, rôle of, in edema, 552
Pertussis (whooping cough), 208
cough in, 206
diet in, 295
dilatation of veins in, 112
pulmonary edema in, 213
treatment of, 208, 266, 267
vomiting in, 295
Petechiæ in acute yellow atrophy of the liver, 520
in epilepsy, during the attack, 520
in hemophilia, 520
in leukemia, 520
in measles and scarlet fever, 520
in phosphorous intoxication, 520
in septic and pyemic conditions, 519
in simple purpura, 520
in ulcerative endocarditis, 519
in Weil's disease, 519
in whooping cough, 520
Petit mal, vertigo in, 746
Phantom tumor in hysteria, 440
Pharyngeal crises in tabes, 651
spasms in rabies, 651
Pharyngismus, occurrence of, 651
Pharynx, tumors of, impairing deglutition, 322
Phenacetin, 66
Phloridzin glycosuria, 588
Phosphaturia, occurrence of, 585
Phosphorus, action of, on heart muscle, 88
intoxication by, 720
fat free diet in, 720
heart action in, 164
hemorrhages in, 492
jaundice in, 416
odor of stomach content in, 348
vagus in, 185
necrosis from, changes in oral mucosa in, 306
Photopsia in sunstroke, 78
Phrenic nerve, irritation of, 251
Phthisis, cavernous, fingers in, 5
peptonuria in, 581
chronic, clubbed fingers in, 117
color of skin in, 3
edema in, 554
intestinal hemorrhages in, 480
overfeeding in, 15

Phthisis, ulcerative glossitis in, 310
Physical exercise, control of, through the pulse, 131
Pigmentation of skin on prolonged use of arsen, 544
Pirquet's reaction in tuberculosis, 631
Placenta, in small and debilitated children, 46
Plague, serum therapy of, 639
Plaques, muqueuses, opalines, hyalines, 322
Plethora, hydremic, in edema, 552
in engorged kidney, 553
vera and serosa, 536
heart and arteries in, 21
Pleura, diseases of, dyspnea in, 215
neoplasms of, pain in, 245
sensitiveness of, on pressure, 244
Pleural adhesions, pain due to, 245
exudate, quantity of, to be removed, 213
Pleurisy, apex beat in, 100
diaphragmatic, pain in, 244
exudative, hyaline casts in the urine in, 584
Head zones in, 245
heart in, 161
pain in, 244
on the sound side, 244
position of the patient in, 233
pulse in, 161
salicylates in, 64
treatment of, 216
Pleuropneumonia, salipyrin in, 66
Pneumaskos, 466
Pneumatic chamber in emphysema, 212
Pneumococcal sera, 636
serum, Römer's, 637
serum therapy, cause of small success of, 637
Pneumonia, abdominal pain in, 431
absence of diazoreaction in, 606
afebrile, asthenic, 128
aspiratory, following angina epiglottidea, 333
in cancer of tongue, 311
in esophageal diverticulum, 327
in tetanus, 653
resulting from postdiphtheric paralysis. 624
bath treatment in, 159
baths in, 209, 210
bilious, 426
bradycardia in, 157
bronchial, following melena neonatorum, 528
cardiac weakness in, combated by digitalis, 135
catarrhal, and capillary bronchitis, 208
in cachectic patients, 210
in obesity, 23
mistaken for croup, 211
treatment of, 211
cholangitis in, 424
crisis in, announced by pulse rate, 157
croupous, cause of death in compensated heart lesions, 130
cough in, 264
crisis and pseudocrisis in, 546
dyspnea in, 209
good sleep and crisis in, 739
in children, 210
respiration in, 71
Pneumonia, croupous, leukocytes announcing crisis in, 546
leukocytosis persisting after crisis in, 546
prognosis of, on absence of leukocytosis, 546
sputum in, 512
dilatation of heart in, 90
dyspnea in, 191
and prognosis, 209
elastic fibers in, 272
endocarditis, 156
facies hippocratica in, 5
food assimilation in, 75
green sputum in, 404
heart in, 156
hypostatic, in paralysis of diaphragm, 662
treatment of, 265
in cardiac insufficiency, 128
in children, 158
mustard pack in, 159
in chorea, 657
in premature children, 47
in scoliotic patients, 209
inciting delirium tremens, 726
jaundice in, 404, 424, 426
leading to meningitis, 707
morphin in, 159, 210
of diebetics, 158
of infants, urobilinuria in, 611
of upper lobe, course of, 246
pain in, 245
partial bath in, technic of, 66
peptonuria in, 581
pseudocrisis in, 58
pulse in, 157
resembling meningitis, 707
Römer's serum in, 637
serous (Traube), 218
simulating perityphlitis, 246
specific treatment of, 209
sputum in, 271
stimulation of cardiac force in, 210
subnormal temperature in, 81
sweating in, 4
tachycardia in, 157
tachypnea in, 209
terminal, in chronic cardiac weakness, 118
toxemia in, 157
use of expectorants in, 264
venesection of, 210
Pneumopericardium, 147
Pneumothorax, apex beat in, 100
dyspnea in, 216
heart in, 162
heart sounds in, 103
on coughing, in tubercular patients, 259
onset of, 216
produced by faulty use of aspiratory apparatus, 562
violent pain in, 245
Poikilocytosis in paroxysmal hemoglobinuria, 549
Points of pressure in the back in abdominal affections, 431
Poisoning by acids, 717
Poisons, means of neutralization of, 714

Poliocencephalitis, acute hemorrhagic, 701
Poliomyelitis, acute anterior, under the picture of cerebral disease, 701
anterior, prognostic importance of reactions of degeneration in, 660
following carbon monoxid posoning, 723
pain in paralyzed extremity in, 667
Pollakuria, nervous, 758
Polyarthritis, rheumatic, 252
leukocytosis in, 547
oral hemorrhages in, 312
Polycrotism of pulse in typhoid fever, 175
Polycythemia in engorged kidney, 553
Polyneuritis in chronic arsenic intoxication, 722
reaction of degeneration in, 659
Polypnea, 191
Polyposis, intestinal, in distomum infection, 507
rectal, hemorrhage in, 509
Polyps, intestinal, and invagination, 393
rectal, 458
Polyuria, associated with dryness of skin, 5
following urinary retention, 762
in nephrolithiasis, 451
occurrence of, 572
Portal circulation and hydrops, 553
vein, stenosis of, jaundice in, 417
thrombosis of, hemorrhagic effusion of peritoneal cavity in, 492
Position, constrained, in pain in the chest, 233
in cardiac disorders, 233
in pleurisy, 233
in stiffness of neck, 233
Postdiphtheritic affections, treatment of, 627
Posticus paralysis, pathogenesis and occurrence of, 664
symptoms of, 664
Potassium chlorate, danger of intoxication with, 321
poisoning by, symptoms of, 719
Pott's disease, abdominal position in, 234
Precordial anxiety, 109
Pregnancy, albuminuria in, 577
and movable kidney, 453
hemoglobinuria in, 550
hemoptysis of, 511
jaundice in, 414
lactosuria in, 589
relation of, to pernicious anemia, 539
salicylates contraindicated in, 65
tachycardia in, 91
vomiting in, 295
Premature birth, signs of, 45
children, constipation in, 370
prognosis in, 47
therapy in, 47
Pressure, abdominal, increased, and circulation, 90
arterial, 97
relieving pain, 439
sensation of, in cardiac affections, 234
Priapism in proctitis, 456
Prize fighters, albuminuria in, 573
Proctitis, gonorrheal, 456
pathogenesis of, 456
tenesmus in, 456
Proctitis, rectal neuralgia following, 463
Progressive paralysis, othematoma in, 531
pulse in, 185
Prolapse of anus and rectum, 460
rectal, in constipation, 374
Proprietary foods poor in fat, 485
poor in protein, 484
Prostate, diseases of, causing pain on defecation, 462
Proteids, coagulation of, in muscle plasm, 61
decomposition of, in tumors, 7
increase of urinary ammonia in, 597
deposit of, conditions of, 11
in diet of consumption 91
indicated in dietary of fever, 77
metabolism of, in cachexia, 7
Protein dyspepsia, milk-sugar in, 485
Proteins and increase of oxidation, 12
as subcutaneous food, 341
best suited for mast cure, 11
decomposition of, in cancer, 592
in fever, 73
in leukemia and pernicious anemia, 542
normal, 73
deposit of, in obese persons, 144
diet of, exclusive, a starvation diet, 593
acetonuria in, 593
in weakened organism, 11
feeding with, and secondary increase of energy, 12
derangements from, 42
loss of, in fat persons, 26
in treatment of obesity, 27
metabolism of, following thyroidectomy, 17
in hyperthyroidism, 17
proprietary foods poor in, 484
putrefaction of, and reaction of stools, 481
in dyspepsia infantum, 484
restriction of, in renal insufficiency, 559
use of, in diet of nephritis, 579
in overfeeding, 12
value of, in rectal feeding, 338
want of, of the normal adult, 73
Protoplasma destruction in fever, 74
"Provocatory" diet as diagnostic aid, 484
Pruritus in jaundice, 405
treatment of, 411
on prolonged use of arsenic, 544
Pseudoangina pectoris, hysterical, 189
Pseudoappendicitis of Garreau, 431
Pseudocollapse in typhoid fever, 82
Pseudocrisis in pneumonia, 58
Pseudoleukemia, blood picture in, 541
Pseudolyssa, 335
Pseudometeorism, 373
Pseudomeningitis, hysteric, 680
Pseudomovements, physiological, relation of, to vertigo, 740
Pseudotetanus, 656
Pseudoulcer, gastric, differentiation of, from true ulcer, 435
Psychical depression in cardiac insufficiency, 129
disorders in intestinal autointoxication, 645
Psychosis, dysphagia in, 336
metabolism in, 18

Psychosis, regimen in, 19
relation of, to cardiac affections, 129
Psychrophore, 456
Puberty, headache of, 681
Puffiness of face in myxedema, 31
Pulmonary calculi, 248
edema in acute nephritis, 560
morphin in, 145
gangrene, dyspnea in, 191
indicanuria in, 601
hemorrhage, simulation of, 509
stenosis, congenital, mixed cyanosis in, 115
leading to tuberculosis, 140
tuberculosis and pulmonary congestion, 512
Pulmonic sound, second accentuation of, 106
in peritonitis, and digestion, 105
in perityphlitis, 105, 164
Pulsation, capillary, in chlorosis, in aortic insufficiency, 181
epigastric, 101, 102
sternal, 101
thoracic, beside the apex beat, 102
Pulse, acceleration of, during digestion, 90
beat, ommission of, 94
relation of, to temperature, 91
count, of children, value of, 71
deficient, 94
diagnostic value of, in loss of consciousness, 183
dicrotism in, 98
frequency of, 90
after physical exercise, 90, 91
age and, 90
body height and, 90
high, 59
in fever, 53
in psychical excitation, 91
in vasomotor neurasthenia of the heart, 120
in woman, 90
position of body and, 90
relation of, to temperature in typhoid fever, 174
high tension of, in plethora vera, 536
hypodicrotic, dicrotic, hyperdicrotic, 98
in aortic aneurysm, 153
in apoplexy, 183
in bronchial asthma, 221
in cardiac affections compared with chronic nephritis, 557
in cerebral hemorrhage, 691
in chlorosis, 180
in collapse, 58
in diphtheria, 168
in emphysema, 160
in heat stroke, 78
in intestinal hemorrhage of typhoid fever, 506
in meningitis, 184
in nephritis scarlatinosa, 171
in obesity, 22, 178
in paroxysmal tachycardia, 149
in pericarditis, 146, 147
in pleurisy, 161
in pneumonia, 157
in puerperal sepsis, 176
in pulmonary edema, 214
Pulse in severe scarlet fever, 635
in typhoid fever, 174, 175
increase of, on inspiration, 96
intermittent, 94
irregular, 94
in scarlet fever, 171
monocrotic, 98
qualities of, 90
quality of, in lead colic, 93
size and shape of, 97
slow, in opium poisoning, 727
tension of, 97
in uremic attack, 731
unequal, 96
venous, negative, 112,
positive, 113
water-hammer, 97
Pulsus abdominalis, in peritoneal affections, 163
alternans, 95
bigeminus, trigeminus, 95
celer, 97
conturnisans, 95
durus, 97
incidens, 95
inspiratione intermittens, 96
intercurrens, 95
mollis, 97
myurus, analogous to Cheyne-Stokes' respiration, 94
paradoxus, 96, 161
stomachicus, 95
tardus, 97
Puncture in liver abscess, 446
of abdominal cavity, 561
of hydropericardium, 562
of hydrothorax, 562
of pericardial sac, 146
Puncturing in pneumothorax, 217
Pupils, contracted, in pachymeningitis, 707
in acute hydrocephalus, 705
in alcohol intoxication, 725
in cerebral hemorrhage, 692
in Cheyne-Stokes respiration, 192
in cocain intoxication, 729
in heat stroke, 78
in migraine, 673
in opium intoxication, 727
Purin N content of some foods, 608
Purpura abdominalis, symptomatology of, 521
fulminans, ecchymoses in, 520
prognosis of, 520
hemorrhagica, 520, 571
rheumatica and polyarthritis, 521
variolosa, hemorrhagic small-pox, 520
Pus in stomach contents, 347
in stools, 479
in dysentery, 479
in neoplasm, 479
in syphilis, 479
in tuberculosis, 479
in typhoid fever, 479
in vomited matter of stomach, 344
Putrefaction, intestinal, and flatulence, 440
Pyelitis calculosa, pain in, 451
hematuria in, 517
Pyelonephritis, purulent, indicanuria in, 602

Pyemia, cholangitis in, 423
following retropharyngeal abscess, 323
Pylethrombosis and pylephlebitis, jaundice in, 417
Pyloric stenosis, cicatricial, 286
treatment of, 287
congenital, gastric secretion in, 350
from cancer, pain in, 436
gastric motility in, 345
residual food in, 351
spastic, hyperchlorhydria in, 350, 351
Pylorospasms, 292
Pylorus and gastralgia, 436
congenital stenosis of, 292
Pyorrhea alveolaris, in phosphorus necrosis, 306
Pyramidon, 66
Pyrosis, 281
in acid hyperesthesia of stomach, 433
Pyrotoxin, 56
Pyuria, decreased excretion of uric acid in, 609
occurrence of, 582

Quinin, as antipyretic, 64
enemas of, in pneumonia, 159
hydrochlorate in children, 73
in sunstroke, 78

Rachitis, capillary bronchitis following, 207
laryngospasm in, 201
Raynaud's disease, edema in, 554
Rectal carcinoma, bleeding hemorrhoids in, 508
feeding, 338
technic of, 340
fissures, tenesmus in, 458
fistula in tubercular periproctitis, 457
polyps and papillomata, melena in, 480
prolapse and bladder stones, 773
Rectum, absorptive powers of, for fat, 339
affections of, 456
cancer of, 458
tenesmus in, 458
catarrh of, 478
congenital stenosis of, 116
digestive power of mucosa of, 338
neuralgia of, 462
pain in, 456
in affections of bladder, 461
in bladder stones, 462
polyps of, 458
prolapse of, 460
differentiation of, from colon prolapse, 460
strictures of, 460
frequency of, 396
pain in, 460
Recurrens nerve, paresis of, in aortic aneurysm, 153
Recurrent fever, jaundice in, 425
liver in, 425
subnormal temperature in, 83
nerve, paralysis of, symptoms of, 664
vomiting with acetonuria, 594
Redness of face during anesthesia, 2
in consumption, 2
in drunkenness, 2
Redness of face in fever, 2
in poisoning with carbon monoxid, atropin, opium, amyl nitrate, 3
unilateral, 2
Reduplication of heart sounds, 105
Reflexes, deep, in uremia, 731
in cerebral hemorrhage, 692
influence of, on circulation, 89
Regurgitation of food in esophageal stricture, 326
in postdiphtheric paralysis, 335
of liquids, in postdiphtheric paralysis, 624
Relapsing fever, leukocytosis in attack of, 548
Renal colic, cardiac weakness in, 136
embolism, infected and cardiac, differentiation of, 585
glycosuria, 588
infarct, anemic, albuminuria in, 577
insufficiency, theories of treatment of, 559
value of cryoscopy of blood for diagnosis of, 550
irritation, in Oertel's cure, 144
through strophanthus, 136
neuralgia, 453
Rennet, addition of, to milk, 484
Renorenal reflex, 451
Reserve power of heart in cardiac hypertrophy, 141
of senile heart, 151
Resistance, lowered, in carbohydrate disorders, 42
in obesity, 178
of breast-fed children, 489
Respiration, abnormally deep, 192
accelerated, and retarded in bronchitis, 206
artificial, in air embolism, 87
in bronchitis of children, 264
in laryngospasm, 202
in syncope, after chloroform anesthesia, 724
in tracheotomy, 205
technic of, 228
auxiliary muscles in, action of, 193
Biot's, 191
in Basedow's disease, 192
in meningitis, posterior, 192
ceasing of, faradization of phrenic nerves in, 716
Cheyne-Stokes, 192
in apoplexy, 192
in arteriosclerosis, 192
in cardiac asthma, 192
in cardiac degeneration, 145
in diabetes, 192
in emphysema, 192
in gangrene of lungs, 192
in meningitis, 192
provoked by morphin, 192
decreased frequency, of, 191
in bronchial asthma, 191
in cerebellar tumor, 191
in fibrinous bronchitis, 191
in mediastinal tumor, 191
in pneumothorax, 191
in purulent meningitis, 191
in stenosis of larynx, 191
deep, in coma of atrophic infants, 44

Respiration, disturbances of, 190
effect of, on circulation, 89
hysterical cramps in, 651
in angina pectoris, 237
in cerebral hemorrhage, 191, 691
in chlorosis, 181
in diabetic coma, 191
in hysteria, 227
in laryngeal croup, 199
in obesity, 21
in pneumothorax, 217
increased, 191
insufficient, in waxy degeneration of muscles, 253
loss of, in brain tumor, 183
of Kussmaul, 733
of the new-born, 192
painful, 192
paresis of, in death from freezing, 79
retarded, in opium poisoning, 727
stertorous, irregular, in uremia, 731
types of, 193
Respiratory center, irritation of, 217
paralysis of, in snake poisoning, 730
through poisons, 230
disorders in nervous diseases, 226
frequency in children, 71
gymnastics in emphysema, 212
organs and obesity, 23
in cardiac insufficiency, 128
spasm, in children, 201
Restlessness of infants, in milk disturbances, 38
Retardation of micturition, 757
Retention, urinary, followed by albuminuria, 577
Retractions of thorax in croup, 211
in emphysema, 211
Retropharyngeal abscess, deglutition in, 323
differential diagnosis of, 323
dyspnea in, 195
following otitis, 323
pathogenesis of, 196
treatment of, 196
Rhagades of mammilla, 255
pain in, 256
Rheumatic pains in thyroidism, 32
Rheumatism, articular, action of antipyrin in, 65
acute, jaw closure in, 312
salicylates in, 66
chronic involvement of jaw in, 312
pain in supraclavicular regions in, 252
complicating epidemic jaundice, 422
fever in, 57
Menzer's streptococcal serum for, 634
bradycardia after, 93
cerebral, 685
muscular, pain in, 254
of abdominal muscles, pain in, 440
Rhinhematoma, 531
Rhinoscleroma, dyspnea in, 196
Rickets, assimilation limit for sugar in, 587
constipation in, 370
incontinence in, 52
ossification and dentition in, 32
painful bones in, 252
Rickets, walking and dentition in, 52
Rigidity, tonic muscular, in microcephalia, 32
Romberg's symptom, 667
Rubner's law of surface development, 75

Sago-granules in stools, 477
Salaam spasm in children, 656
Salicylates as antipyretics, 64
in pregnancy, 65
Salipyrim, in children, 73
in influenza, 66
action of, 66
Salivary glands, inflammation of, 309
Salophen, 66
Salt free diet in cardiac edema, 131
in nephritic edema, 559
solution, infusion of, in hemorrhages, 498
Sapremia, pathogenesis of, 614
Sarcinæ, in stomach content, 352
in vomited matter, 286
Sarcoma, intestinal, 383
vascular, pulsation in, 102
Sausage poisoning, symptoms of, 729
Scar pain in gastric ulcer, 435
Scarlatina maligna, heart death in, 170
Scarlatinal nephritis, hemorrhagic, prognosis of, 516
Scarlet fever, albuminuria in the first week of, 577
angina in, 318
bath in, 69
desquamation in, 6
diazo reaction in, 606
double exanthem in, 635
eosinophilia in, 547
erroneous diagnosis of, in erethistic individuals, 2
esophagitis in, 328
headache in, 684
heart in, 170
hematuria in nephritis of, 515
jaundice in, 427
hyperpyrexia and prognosis of, 635
leukocytosis in, 547
liver in, 427
Moser's serum in, 172, 634
effect of, on angina in, 193
myocarditis in, 145
nephritis in, 171
heart in, 171
involvement of glomeruli in, 557
lumbar puncture in uremia in, 731
peritonsillar abscess in, 316
prognosis of, 635
pulse in, accelerating action of toxin on, 170
frequency of, 59
tachycardia in, 71, 91
urobilinuria in, 427
vomiting in, 299, 301, 302
Schmidt's test meal, for functional diagnosis of intestines, 470
School anemia, 9
Schott's carbonic acid baths in circulatory disorders, 569
movements in heart lesions, 124

Schultze's method of artificial respiration in the new-born, 228
Schweninger's modification of Oertel's treatment, 144
Sciatica, hemorrhage in, 493
Sclerema in infants, 368
of the new-born, 569
Scleroderma, 80, 81
of the new-born, 569
Sclerosis, multiple, dyspnea in, 185
palpitation in, 185
temperature in, 54
Scoliosis, atelectasis in, 229
influencing dyspnea in pneumonia, 209
Scotoma, central, in tobacco intoxication, 239
Screaming of child in hydrocephalus, 706
Scrofula, constiptaion in, 2
oral ulcers in, 307
Scurvy, care of teeth on onset of, 523
death from hemorrhage in, 522
eye affections through hemorrhage in, 522
gingivitis in, 311
hemothorax in, 514
hydrops in, 554
impaired vision in, 522
intestinal hemorrhage in, 523
meningeal hemorrhages in, 522
pain and fever on hemorrhages in, 522
prophylactic diet in, 522
symptomatology of, 521
use of lemon juice in, 522
Sea-sickness, heart and pulse in, 189
simulated by cholera, 751
simulated by uremia, 751
symptoms of, 751
Secondary infection, 616
Secretions, glandular, in fever, 60
influence of infectious diseases on, 618
scanty, tenacious, in lung diseases, 273
Sediments, organized, aside from casts, 586
urinary, examination of, 583
unorganized, 585
Sedimentum lateritium, 585
Sensitiveness to percussion in bronchopneumonia and tuberculosis, 237
in pneumonia and pleurisy, 234
in pneumothorax and in pericarditis, 234
Sepsis, acute, treatment of fever in, 70, 71
heart in, 176
of the new-born, jaundice in, 428
puerperal, pulse in, 176
umbilical, 428
Septicemia, bulbar symptoms in, 335
diazo reaction in, 606
following angina epiglottidea, 333
following cancer of tongue, 311
following noma, 309
in omphalorrhagia, 527
in Winckel's disease, 529
intestinal ulcers in, 508
jaundice in, 427
leukocytosis in, 547
perihepatitic fremitus in, 428
waxy degeneration of muscles in, 253
Septum defects without cyanosis, 114
Serous membranes, leukocytosis in inflammation of, 546
Serum disease, 342
symptoms of, 626
treatment in bacillary dysentery, 507
Shortness of body in rickets, 32
in osteomalacia, 33
in senile osteoporosis, 33
Sighing, subjective dyspnea, 190
Sigmoiditis and carcinoma of sigmoid, 396
stercoral, primary, 438
Silver nitrate intoxication, 719
Singultus, see Hiccough
in aortic aneurysm, 244
in mediastinal affections, 246
in peritonitis, 385, 454
through compression of phrenic nerve in aortic aneurysm, 153
Sinus phlebitis, symptoms of, 677
Sinus thrombosis, edema of face in, 554
in infants, 699
occurrence and pathogenesis of, 699
symptoms and diagnosis of, 699
Sitophobia in psychosis, 18
treatment of, 19
Skatol and odor of feces, 472
Skin, bronzed, in cirrhosis of liver, in diabetes, in Addison's disease, 3
color of, in gastrointestinal disorders of infancy, 3
in phthisis, 3
elasticity of, in states of dehydration, 5
eruptions of, following quinin, 64
following use of antipyretics, 729
hemorrhages of, 519
in chronic malaria, 426
inspection of, and blood picture, 1
moisture of, 4
paleness of, 1
scarlet, in atropin poisoning, 729
Sleep, physiological, 736
typus inversus of, 737
Sleepiness, in brain tumor, 702
Sleeplessness associated with other symptoms, 736
causes of, 737
chronic, in syphilitic meningitis, 737
classification of, according to mode of manifestation, 737
due to palpitation in disturbed compensation, 126
general pathogenesis of, 736
in Basedow's disease, 186
in children, 739
in delirium tremens, 739
in fever, 737
in heart diseases, 739
in irritable heart, 119
in nervous affections, 737
in neurasthenics, 737
in thyroidism, 32
treatment of, 737
without pain, 737
Small-pox, esophagitis in, 328, 329
hydrotherapy in, 69
leukocytosis in, 547

Small-pox, temperature curve and headache in, 684
vaccination against, 640
Snake bites, hemorrhages following, 493
jaundice following, 421
symptoms of, 730
Sneezing, spasmodic, occurrence of, 651
Snoring during sleep, 195
Soap stools in chronic nutritive disorders of infants, 598
Sodium salicylate in children, 73
Somnolency in cardiac insufficiency, 130
in fever of children, 71
in premature children, 47
Sopor, in alcohol intoxication, 725
in fever, 59
in hematoma of the dura of the new-born, 708
Soporifics in insomnia, 738
Sounds, passing of, in esophageal affections, 324
Soxhlet's nutrient sugar in protein dyspepsia, 485
Spasms, definition and division of, 648
esophageal, 279
in tetanus and lyssa, 335
frequency of, in childhood, 649
in carbon monoxid poisoning, 723
in intestinal autointoxication, 645
in opium intoxication, 727
of deglutition, in hydrophobia, 628
of extremities, in acute hydrocephalus, 705
pathogenesis of, 649
pharyngeal and esophageal, in hysteria, 335
tendency to, in first years of life, 710
tonic, of jaw, neck and face, in tetanus, 629
vascular, causing paleness of face, 1
Spastic paresis in hydrocephalus, 706
Specific remedies in infections, 621
treatment of infectious diseases, 622
Speech, center of, 52
development of, and feeble-mindedness, 52
disturbances of, prognosis of, 52
disturbed, in hereditary syphilis, 52
loss of, in cerebral hemorrhage, 692
nasal, following diphtheria, 624
retarded development of, 52
Sphygmograph, value of, 98
Spinal cord, diseases of, heart in, 185
Spirometer, use of, in emphysema, 212
Splanchnic nerve, paresis of, 86
Spleen, abscess of, acute, pain in, 450
embolism of, pain in, 450
engorged, 450
enlarged, in infarct formation in endocarditis, 450
enlargement of, in cardiac stasis, 126
in catarrhal jaundice, 407
in infectious diseases, 618
extirpation of, in Banti's disease, 544
laceration of, in malaria, 450
movable, pain in, 450
pain in, 450
rupture of, 450
Splenomegaly and icterus, 412
causing albuminuria, 574
in Weil's disease, 423
Splenopexis (Rydigier), 450
Spondylitis, abdominal position in, 234
Sports and heart hypertrophy, 141
Sputum, 269, see also Expectoration
acidity of, in putrid bronchitis and pulmonary gangrene, 273
albuminous, expectoration of, in pulmonary edema, 273
amount of, 269
asthma crystals in, 272
bacilli in, 272
bloody, in pulmonary embolism, 211
cheesy particles in, 271
chemical examination of, 273
collection of, in young children, 269
color and transparency of, 270
consistency of, 270
crudum and coctum, 270
danger of swallowing, 361
decomposed, secretion of, 276
Dittrich plugs in, 271
elastic fibers in, 272
examination of, therapeutic indications resulting from, 273
fibrin clots in, 271, 276
foamy, in pulmonary edema, 213
on puncture of hydrothorax, 562
green, in pneumonia, 271, 404
hematoidin in, 511
hematoidin crystals in, 272
in bronchiectasis, putrid bronchitis and gangrene, 270
in croupous pneumonia, 512
in hemorrhagic infarct of lungs, 512
macroscopic examination of, 269
microscopic examination of, 272
nummular, 270
odor of, 271
pieces of cartilage in, 272
shreds of lung parenchyma in, in gangrene, 272
spirals in, 271
stratification of, 270
swallowing of, and digestion, 15
thread-like, 270
tubercle bacilli in, 272
Staggering and vertigo, 740
in Ménière's disease, 710
Staggering gait in brain tumor and brain abscess, 745
Staphylococcus sera, 633
Starch enemas, 339
Starch in stools, test for, 474
Stasis and hemorrhage per diapedesis, 491
and nephritis, 557
Status lymphaticus and thymus hyperplasia, 204
Stenocardia, 236
insomnia in, 739
Stenocardial attacks, in liver diseases, 164
Stenosis, intestinal, due to coproliths, 374
from carcinoma, 383
pyloric, congenital, 45
Stercoral obstruction, 394
Sterilization of milk, 290
Sternal pulsation, 101
Sternoclavicular articulation, pain in, 252

Sternum, caries of, 251
Stoke's mixture in fatty degeneration of heart, 144
Stomach, acid hyperesthesia of, 433
affections of, acetonuria in, 594
constipation in, 380
vomiting in, 279
atony of, effect of, 346
motility in, 345
cancer of, coffee ground vomiting in, 347
hemorrhage in, 504
capacity of, in infancy, 35, 290
carcinoma of, cancer-cell nests in gastric sediment in, 352
lactic acid in, 351
catarrh of, stomach contents in, 353
chemical analysis of gastric juice, 348
chemical function of, and food residue, 344
contents of, changes in the food retained, 346
danger of retention of, 345
examination of, 344
gas bubbles in, 346
in the common diseases of stomach, 353
lactic acid in, 351
layer formation of, 346
microorganisms in the healthy, 352
microscopical examination of, 352
odor of, 347
sarcinæ in, 352
trypsin in, 352
yeast-cells in, 352
dilatation of, 282
gas bubbles in the content in, 346
gastric contents in, 354
heart sounds in, 103
diseases of, indicanuria in, 601
disorders of, produced by caffein, 137
disturbed secretion of, connective tissue in stools in, 473
fasting, examination of contents of, 344
function of, in cardiac insufficiency, 129
hemorrhage of, 503
hour-glass, lavage symptoms in, 283
hyperesthesia of, 300
hypersecretion in, 350
lavage of, contraindicated in intoxication with cauterizing acids, 718
in ileus, 401
in infants, 284
in intoxications, 281
indications and contraindications for, 284
rinsing fluid in, 283
technique of, 282
time for, 283
motility of, disorders of, 345
in infants, 351
motor insufficiency of, 345
and autointoxication, 346
food residue in, 344
indications for operation in, 357
treatment of, 357
mucus in catarrh of, 354
neurosis of, differential diagnosis of, from ulcer, 300
normal time of emptying, in infants and adults, 345
Stomach, nourishment following operations on, 337
pain in, 432
pressure of, in chronic cardiac weakness, 118
pulsus stomachicus in, 95
pumping of, contraindication to, in strong caustic poisons, 281
relation of motility and secretion in, 345, 346
secretion of, disturbances of, 350
in infants, 350
secretory neuroses of, 354
symptoms in following constipation, 373
Stomatitis, act of swallowing in, 305
aphthous, 307
catarrhal, 305, 306
in febrile diseases, 306
due to lead, 306
due to physical irritation, 305
due to thrush (oidium albicans), 308
following use of calomel, 378
gangrenous, in acute leukemia, 310
in measles, 308
gonorrheal, of the new-born, 308
in influenza, 306
in somnolence, 307
mercurial, initial sign of mercurial poisoning, 305
occurrence of, 305
ulcerosa, 319
Stools, see Feces
acholic, 405, 471, 472
in absence of jaundice, 471
black, causes of, 471
blood in, 479
in intestinal carcinoma, 383, 395
in intestinal thrombosis, 398
in intestinal invagination, 393
casein in, 39
clay colored, in chlorosis, 472
copious, foul, in protein dyspepsia, 42
cow milk, 369
epithelial cells in, 478
examination of, indication of diet, 481
of infants, indicating diet, 482
fat in, 39, 473, 475
in infants, 476
in pancreatic affections, 476
occurrence of, 475
foamy, in sugar dyspepsia, 485
forms of, in constipation, 373
in intestinal stenosis, 472
in spastic constipation, 372
frequency of, in breast-fed children, 369
green, 471
in scarlet fever, 635
in amebic dysentery, 507
in chronic dyspepsia of children, 484
in duodenal ulcer, 504
in dyspepsia of artificially fed infants, 483
of breast-fed infants, 482
in fat dyspepsia, 471
in follicular enteritis, 639
in gastroenteritis of infants, 43
in jaundice, 403
of malaria, 426
in liver atrophy, 415

Stools, in milk dyspepsia of breast-fed children, 40
in syphilitic jaundice, 429
in undernourished infants, 41
in Weil's disease, 423
mucus in, 477
necrotic shreds of pancreatic tissue in, 24
of infants, color of, 471
in milk dyspepsia, 38, 39
pus in, 479
in intestinal carcinoma, 383, 395
reaction of, 480
ribbon-like and sheep stool form of, 472
slimy-greenish, in infants, 40
tumor tissue in, in intestinal carcinoma, 383
varnished appearance of, 373
white, in infants, 471
Strabismus, in acute hydrocephalus, 705
postdiphtheric, 624
Straining on defecation, cause of, in children, 461
Strangulation, intestinal, 391
Strangury, see Bladder
at day-time and at night-time, 756
Streptococcus sera, 633
contraindications for, 636
indications for use of, 636
most commonly used, 636
Striæ following edema, 555
Stridor congenitus, 199
following influenza, measles, pneumonia, 204
in aortic aneurysm, 153
in laryngeal stenosis due to goiter, 203
in retropharyngeal abscess, 323
in swollen bronchial glands, 249
Strumitis, see Thyroiditis
Strychnia in heart affections, 138
Strychnin intoxication, first symptoms of, 138
Styptics in hemoptysis, 510
internal, 495, 497
of local action, 495
Subclavian artery, ligation of, in aneurysms, 155
Sublimate intoxication, symptomatology of, 721
Succorrhea, gastric, chronic, pain in, 433
Sucking, act of, in tetanus neonatorum, 304
hindered, by changes in oral floor, 304
impaired, by cleft palate, 303
by coryza, 305
Suffocation, attack of, in fistula of esophagus and trachea, 326
in laryngeal syphilis, 334
in glottis edema (of glossitis), 309
nocturnal attacks of, 226
through esophageal tumors, 322
Sugar, see also Glycosuria
assimilation limit of, in rickets, 587
of Hofmeister, 587
dyspepsia, foamy stools in, 485
enemas, 338
ferments producing, in early infancy, 39
Suggestion in hysteria, 661
Sulphuric acid poisoning, symptomatology, of, 717
Summer diarrhea, heart in, 177
Sunstroke (insolation), 78
treatment of, 78
Surface development, law of, 75
Swallowing, difficulties in, forms of, 314
in esophageal diverticulum, 327
in pericarditis, 242
in retropharyngeal abscess, 196
in rheumatic polyarthritis, 312
disturbed reflex of, 334
hindered, in thrush of esophagus, 330
impossibility of, in healthy individuals, 314
of air, cause of flatulency, 441
pain on, in esophagitis, 328
trouble in, in stomatitis, 305
Sweat, as sign of atony of cutaneous vessels, 83
in nephrolithiasis, 451
cold, in collapse, 58
in epilepsy, 708
in heat accumulation, 80
in malaria, significance of, 4
in pneumonia, 158
in pneumothorax, 162
in polyarthritis, polymyositis, polyneuritis, 4
in septic processes, 4
in tetanus, profuse, 652
in typhoid fever, significance of, 4
on exertion in cardiac weakness, 118
secretion of, effect of toxins on, 618
following antipyrin, 65
following mallein, 618
in infections, 618
sour, in polyarthritis, 618
Swooning spells in Basedow's disease, 746
occurrence of, 697
Symbiosis of bacteria, 620
Sympathetic nerve, galvanization of, in compensated heart lesions, 124
signs of irritation of, 2
Syncope following defecation, 698
following loss of blood, 494
in affections of the brain, 698
in chloroform anesthesia, 724
in hyperesthesia of the solar plexus, 439
in infectious diseases, 698
in insufficient cardiac force, 697
in internal hemorrhage, 163
in obesity, 178
in stenocardia, 110
on getting up after rest in bed, 543
on puncture of hydrothorax, 562
pathogenesis and occurrence of, 697
symptomatology of, 697
treatment of, 698
Syphilis, 6
causing hemoglobinuria, 549
causing hemorrhagic diathesis of the newborn, 527
causing suprarenal hemorrhage, 532
cerebral, diagnosis of, 704
treatment of, 705
congenital, epistaxis in, 526
umbilical hemorrhage in, 526
headache in, 685
hereditary, and Banti's disease, 542
aphasia in, 52
hematoporphyrinuria in, 583
icterus neonati due to, 429
intelligence in, 52

Syphilis, hereditary, kidneys in, 581
nephritis without albumin and casts in, 58
of the brain, 705
intercostal neuralgia in, 255
interstitial hepatitis in, 429
intestinal, pus in stools in, 479
intestinal ulcers in, 508
jaundice in, 429
of brain, forms of, 704
vertigo in, 744
of esophagus, 329
of heart, and angina pectoris, 238
of larynx, 199, 334
of liver, jaundice in, 413
of tongue, 310
of tonsils, 321, 322
primary and tertiary, 319, 320
præcox, of nervous system, 686
tertiary, hemoptysis in, 513
Syphilitic ulcer of the intestine, hemorrhage in, 508
Syringomyelia, vertigo in, 749
Systole, pericardial adhesions in, 87
Systolic retractions, 102

Tabes, abdominal crises of, 455
anal-perineal neuralgia in, 462
coccygodynia in, 463
dorsalis, angina pectoris in, 239
decreased desire to urinate in, 759
disorders of urination in, 767
heart and pulse in, 185
loss of consciousness in, 222
manual expressibility of bladder in, 766
nystagmus in, 753
sudden dyspnea in, 222
urinary troubles in, not functional, 757
vertigo in, 749
vomiting in, 298
gastric crises in, 455
and periodical vomiting, 301
girdle sensations in, 255
hepatic crises of, 449
pains in, 666
pharyngeal crises of, 651
urethral crises of, 462
Tachycardia, afebrile, in infectious diseases, 91
as focal symptom in brain tumor, 183
bacteriotoxic, 91
definition of, 91
febrile, 58, 91
Liebermeister's rule in, 91
following bradycardia, 182
in atropin poisoning, 367, 729
in Basedow's disease, 187
in cardiac neurosis, 188
in cardiac weakness, 85
in cervical myelitis, 185
in chlorosis, 180
in chronic pulmonary tuberculosis, 161
in climacteric period, 188
in cocain intoxication, 729
in diphtheria, 168
in encephalitis, 183
in goiter, pathogenesis of, 186
in Graves' disease, 92
Tachycardia, in heat stroke, 78
in hysteria, 189
in influenza, 177
in intestinal and internal hemorrhage, 163
in lymphatic leukemia, 179
in meningitis, 91, 184
in miliary tuberculosis, 160
in morphin intoxication, 728
in myocarditis of typhoid fever, 175
in neurasthenia, 92
in pericarditis, 146
in peritoneal affections, 163
in phosphorus intoxication, 185
in pleurisy, 161
in pneumonia, 157
in poisoning with digitalis, 93
in postinfectious neuritis of vagus, 185
in sausage poisoning, 729
in scarlet fever, 71, 170
in tabes dorsalis, 185
in thyroidism, 32
in traumatic neurosis, 92
in vagus paralysis 91, 663
individual disposition to, 91
nutrition of heart in, 85
of pregnancy, 91
paroxysmal, 92
definition of, 149
produced by external heat, 91
produced through stimulation of cerebral cortex, 182
sudden, in typhoid fever, significance of, 163
through compression of vagus, 186
Tachypnea, febrile, 59
in carcinomatous coma, 734
in cocain intoxication, 729
in hydrocyanic acid intoxication, 718
in hysteria, 227
in pneumonia, 209
in thyroidism, 32
Talking, delayed, 52
Talma operation in liver cirrhosis with ascites, 570
Tardieu's (Bayard) spots, 491
Tarry stools in esophageal and gastric hemorrhages, 479
Tartaric acid poisoning, 717
Taste, disturbances of, 667
nerves for, 668
pappy, in febrile diseases, 306
Teeth, gnashing of, in acute hydrocephalus, 705
Temperature and virulence of bacteria, 60
anomalies of, 53
curves of, 57
elevations of, transient, in tuberculosis, 77
in cerebral hemorrhage, 692
in ileus, 399
in intestinal hemorrhage of typhoid fever, 506
in uremia, 731
increased, causes of, 54
liability of, in congenital heart lesions, 116
low, in congenital heart lesions, 81
in nervous diseases, 81
postmortal rise of, 58
rapid fall of, sign of uremia, 61
rectal, low, in congenital debility, 80

Temperature, subnormal, 79
following hemorrhage, 82
in Addison's disease, 82
in alcohol intoxication, 725
in cachexia, 83
in cardiac insufficiency, 126
in diabetic coma, 81
in diphtheria, 83
in exanthematic typhoid, 82
in infectious diseases, 82
in intoxications, 82
in medullar apoplexy, 82
in myxedema, 82
in paralysis, 81
in pernicious malaria, 83
in progressive paralysis, 183
in recurrent fever, 83
in snake poisoning, 730
treatment in, 83
sudden fall of, 57
in hemorrhage, 82
in perforation, 82
sudden rise of, in atropin poisoning, 367
Tenderness, abdominal, see Abdominal pain
Tenesmus, 456
in carcinoma of rectum, 384, 458
in cystitis, 462
in diarrhea, 456
in dysentery, 458
in enteritis, 458
in helminthiasis, 458
in hemorrhoids, 459
in intestinal invagination, 393,–458
in periproctitis, 457
in proctitis, 456
in purpura abdominalis, 521
in rectal polyps, 458
in syphilitic ulcers of rectum, 456
in volvulus of the sigmoid, 391
of bladder, 755, see also Bladder and rectum, 566
Test meals, 344
Testicle, incarcerated, simulating ileus, 397
Testis, irritable, spermatic neuralgia, 462
Tetanus, antitoxin for, indications for use of, 629
mode of action of, and prognosis, 629
place of injection of, 630
cellular antitoxins of the brain in, 630
differential diagnosis of, 652
facial, 652
forms of, 652
importance of subdural injection in, 654
in domestic animals, 629
neonati, feeding in, 304
neonatorum, ingestion in, 304
symptoms of, 653
pain in the heart region in, 252
prognosis of, 652
sera for, 630, 654
specific treatment of, 629
symptomatic, in oxalic acid poisoning, 718
symptomatology of, 652
through gelatin injections, 487
tonic spasms of, 629
traumatic, importance of careful nursing in, 653
Tetany, edema on dorsum of foot in, 570
of children, 655
occurrence of, 654
parathyroid glands in, 654, 655
symptoms of, 654
Theobromin, 137
Thermogenesis, 56
Thoracocentesis, in pleurisy, indication for, 162
Thoracotomy in purulent plurisy, 216
Thorax in capillary bronchitis, 207
in emphysema, 211, 212
movements of, and circulation, 89
pain in, 233
Thrombosis, cerebral, 696
symptomatology of, 696
in the heart in diphtheria, 169
sinus, in chlorosis, 181
Thrombus, formation of, in cardiac insufficiency, 128
induced formation of, in aortic aneurysm, 154
Thrush, in throat and pharynx in cardiac insufficiency, 126
of esophagus, 330
sign of gastrointestinal disorders, 308
stomatitis and, 308
Thymus, apoplexy of, 533
enlarged, 204
physical findings in, 534
hyperplasia of, and status lymphaticus, 204
in goiter, 204
in stridor congenitus, 199
Thyroid extract, contraindicated in myocarditis, 186
in fatty heart, 143
gland, diseases of, and anomalies of development, 131
fresh, in goiter, 204
hemorrhage into, 533
in cretinism, 31
therapy, protein decomposition in, 29
Thyroidectomy and metabolism, 17
Thyroidin in goiter, 204
Thyroidism, symptoms of, 32
Thyroiditis, heart in, 186
hemorrhage in, 533
Tinnitus aurium, following quinin, 64
in Ménière's disease, 747
in sunstroke, 78
Tobacco and fatty heart, 21
heart and angina pectoris, 238
intoxication, bradycardia in, 92
Tongue, actinomycosis, lupus and leprosy of, 310
anomalies of, influencing ingestion, 304
carcinoma of, forms and appearance of, 310
diseases of, hindering mastication, 309
in act of swallowing, 334
in cerebral hemorrhage, 692
in circulatory disturbances, 129
in leukemia, 310
longitudinal cleft of, 304
nerve supply of, 668
opalescent, in influenza stomatitis, 307
syphilis of, forms of, 310
Tonsillary abscess, treatment of, 195
affections, dyspnea in, 195

Tonsillary stones, 316
Tonsillitis, followed by jaundice, 423
Tonsils, enlargement of, in rheumatic polyarthritis, 312
in angina lacunaris, 315
in diphtheria, 317
place of entry of, in scarlet fever, 319
syphilis of, primary, frequency of, 321
secondary, 322
tuberculosis of, 321
Toxemia, in pneumonia, 157
Toxins, bacterial, and fever, 56
Trachea, stenosis of, 202
following tracheotomy, 204
in retropharyngeal abscess, 323
producing dyspnea, 203
Tracheo-bronchitis of children, 206
Tracheotomy in aortic aneurysm, 156
in carbon dioxid intoxication, 231
in diphtheria, 626
in edema of glottis, 200
in larynegal croup, 627
in laryngeal diphtheria, 198
in laryngeal stenosis, 197, 203
in morphin poisoning, 728
in paralysis of posticus, 664
in pulmonary edema, 214
in respiratory apnea, 202
in respiratory disorders of hysteria, 227
in rhinoscleroma, 194
indications for, 626
ingestion in, 337
Transfusion, experiments in, in pernicious anemia and leukemia, 544
fever in, 54
of heterogenous blood, 231
Transudates and exudates, differentiation of, 556
Trauma, danger of, in hemophilia, 524
of lungs, hemoptysis in, 513
Traumatic neurosis, 680
Tremor, occurrence of, 648
Trichiniasis, albuminuria; in, 554
inflammatory edema in, 554
symptomatology of, 555
Trichinosis, death in, from bronchopneumonia, 234
difficulty in swallowing in, 330
intestinal disorders in, 253
pain on respiration in, 253
paralysis of diaphragm in, 662
Tricuspidal regurgitation, positive venous pulse in, 113
Trismus (closure of jaw) in articular diseases, 312
in carbon monoxid poisoning, 723
in influenza, 313
in opium poisoning, 727
in oxalic acid intoxication, 718
in tetanus, 652
in trichinosis, 654
occurrence of, 654
reflex, due to intestinal parasites, 314
rheumatic, 313
Trochars, capillary, use of, in hydrops, 563
Trousseau's spots, 2
Trypsin, in stomach contents, 352
Tubercular ulcers of intestines, 361
frequency of strictures in, 396
hemorrhage in, 508
Tuberculin, albumosuria following use of, 582
and jaundice, 420
as diagnosticum, 630
headache following injection of, 685
Koch's, 630
lymphocytosis following the injection of, 546
mode of action of, 630
reaction, and gravity of disease, 631
in actinomycosis, lepra and syphilis, 631
specificity of, 631
therapeutical attempts with old, 632
treatment with, and diazoreaction, 607
use of, followed by hemoptysis, 513
Tuberculosis, acute miliary, abscence of bacilli in sputum in, 273
and periproctitis, 457
anemia in, 538
Behring's milk treatment of, 632
chronic, hemophilia in, 492
pulmonary, dyspnea in, 214
heart in, 161
terrain cure in, 215
diazo-reaction in, 606
differential diagnosis of, from capillary bronchitis, 208
fatty degeneration of liver in, 141
fever in, 63
hectic, 621
immunity in, 630
intestinal, in children, 616
intestinal stenosis in, 396
meteorism in, 465
pus in stools in, 479
intestinal ulcers in, 508
Maragliano's serum in, 632
Marmorek's serum in, 632
miliary, dyspnea in, 211
heart and pulse in, 160
mixed infection in, 273, 619
mode of infection in, 616
of bladder, 772
of bronchial glands, cough in, 267
of children, indicanuria in, 601
of esophagus, 329
of larynx, 199, 333
of oral and pharyngeal cavity, deglutition in, 321
of palate and pharynx, 321
of soft palate, 311
of tongue, diagnosis of, 310
pain, in, 310
ophthalmo-reaction in, 632
passive immunization in, 632
peritoneal, stools in, 471
pharyngeal, resembling luetic affection, 321
Pirquet's cutaneous reaction, 631
pulmonary, and pulmonary stenosis, 140
blood coagulation in, 510
cough in, 265
diarrhea in, 361
fatty heart in, 142
in obesity, 23

Tuberculosis, pulmonary, rest cure in, 215
subcutaneous feeding in, 342
suspected, thermometry in, 77
tachycardia in, 91
vomiting in, 295
specific treatment of, 630
treatment of, with cinnamonate of sodium, 632
Tumors, abdominal, causing intestinal compression, 394
benign intestinal, causing hemorrhage, 509
causing jaundice, 406
intestinal, mobility of, 384
malignant, leukocytosis in, 549
of jaws, 312
of larynx, 199
pelvic, significance of leukocytosis in, 548
sickle-shaped, in intussusception, 393
stercoral, causing obstruction, 394
sublingual, in infants, 304
Turbinates and gastralgia, 437
Twitching, fibrillar, occurrence of, 648
muscular, in morphin posioning, 718
Typhoid fever, 6
acetonuria in, 591
and cholecystitis, 424
antipyrin in, 65
ascent of fever in, 57
assimilation in, 75
bath treatment of, time for, 69
bilious, 425, 426
relation of, to recurrent fever, 425, 426
bradycardia in, 91
in children, 91
brain abscess in, 702
Brand bath in, 67
bulbar symptoms in, 335
bulemia in, 8
capillary bronchitis in, 206
cardiac changes in, 174
cholangitis in, 423
conjugated sulphuric acids in, 603
diazo-reaction in, 666
dysphagia in, 335
encephalitis in, 701
esophagitis in, 328
exanthematic, jaundice in, 425
temperature in, 82
headache in, 683
indicanuria in, and its significance, 601
intestinal hemorrhage in, 505
jaundice in, 404, 425
leukopenia in, 548
liver abscess in, 446
loss of weight in, 8
meteorism in, 466
myocarditis in, 145
oxygen consumption in convalescence of, 13
paralysis of bladder in, 760
passive immunization in, 638
perichondritis of larynx in, 333
pneumaskos in, 466
pseudo collapse in, 82
pus in stools in, 479
Typhoid fever, relapse in, announced by reappearance of diazo-reaction, 607
relative lymphocytosis in, 548
significance of leukocytosis in, 548
stools in, 472
subnormal temperature in, 82
sudden fall of temperature in, 58, 82
sudden pallor in, 1
syncope in, on sitting up, 698
tender splenic tumor in, 450
tenderness on percussion in, 432
urinary retention in, 768
urobilinuria in, 425
waxy degeneration of muscles in, causing pain, 253
Ziemssen bath in, 67
Typhoid ulcers and intestinal stenosis, 396
Typus inversus, of fever, 57

Ulcer, duodenal, following burns, 360
localization of pain in, 431
pain in, 504
pathogenesis of, 503
simulating cholelithiasis, 447
stools in, 504
vomiting and pain in, 285
gastric, bradycardia in, 94
indicanuria in, 601
relation of, to chlorosis, 501
intestinal, diarrhea in, 360
etiology of, 360
in leukemia, 508
inflammatory pain in, 438
treatment of, 361
of bladder, producing hematuria, 518
of cardia and esophagus, blood in, 504
pain in, 504
of esophagus, 328, 329
of mouth, in stomatitis ulcerosa, 319
of stomach and nervous vomiting, differentiation of, 300
and pseudo ulcer, 435
constipation in, 381
diet in, on bleeding, 502
effect of faradization on pain in, 435
gastric contents in, 354
headache and vertigo in, 381
hematemesis in, 501
pain in, 434
in the back, 431
position influencing, 434
scars of, causing pain, 435
sudden pallor in, 1
treatment of, 356
treatment of hyperchlorhydria in, 356
vomiting in, 284
oral, in mercurial poisoning, 306
peptic, of esophagus, 329
stercoral, perforation of, 369
syphilitic, of tonsils, 322
tubercular, of the tongue, 310
Ulcerations in oral cavity, 307
Umbilical arteritis and phlebitis, 428
hemorrhage in Buhl's disease, 529
parenchymatous, in congenital syphilis, 526

Umbilical sepsis, 428
wound, hemorrhage from, 526
Unconsciousness following rupture of middle meningeal artery, 713
in alcohol intoxication, 725
in concussion of brain, 712
in embolism of brain, 695
in epilepsy, 694
in hemorrhage of the brain, 691
in internal hemorrhage, 690
in opium poisoning, 727
in thrombosis of cerebral arteries, 696
in trauma of skull, 712
in uremic seizure, 731
pathogenesis of, 690
Undernourishment in neuropaths, 9
Undernutrition, of breast-fed children, symptoms of, 40
of infants, treatment of, 41
Urea formation in cardiac insufficiency, 129
Uremia, bradycardia in, 93
cardiac hypertrophy in, 167
dyspnea in, 224
following urinary retention, 762
ileus in, 398
in diphtheria, 624
in nephrolithiasis, 451
intestinal ulcers in, 360, 508
odor of stomach contents in, 348
oliguria and fall of temperature announcing, 61
relation of, to ammonemia, 597
respiration in, 191
symptomatology of, 731
treatment of, 731
Ureter, kinking of, following obesity, 24
Urethra, hemorrhage from, 518
Urethral crises in tabes, 462
reactions following instrumental intervention, 771
Uric acid, causes of, increased excretion of, 608
coefficient in various ages of life, 610
content of the blood, conditions with increase of, 610
decreased excretion of, 609
diathesis and obesity, 20
asthmatic attacks in, 224
endogenous, and hyperleukocytosis, 608
proofs for existence of, 608
quantity of elimination of, 608
excretion of, in children, 610
in the new-born, 610
formation of, 607
increased excretion of, 608
infarct, and albuminuria in the new-born, 580
of the new-born, 610
metabolism, normal, 607
relation of, to food, 607
to nitrogen metabolism, 607
to nuclein bodies, 607
Urinary calculi in children, 774
symptoms of, 773
treatment of, 773
disinfectants, 599
pigments, and renal parenchyma, 610
retention, 656
Urinary retention, acute, symptoms of, 761
by reflex action, 755
chronic, complete and incomplete, 762
effect of, on the kidneys, 761
following laparotomy, 761
in appendicitis, 755
in genital affections of women, 755
in old age, 760
in rectal affections, 755
in syringomyelia, 768
in tetanus and tetany, 770
occurrence of, 760
pain and absence of pain in, 761
treatment of, 761
secretion, diminished, preceding uremia, 731
sediment, examination of, 583
Urination, absence of, significance of, in the new-born, 760
changes in frequency of, 758
decreased impulse to, 758
in undernourished infants, 41
Urine, acetone bodies in, 589
acidity of, in diabetic coma, 734
in liver affections, 596
ammonia increase of, 596
aromatic substances in, 599
color of, in carbolic acid poisoning, 725
deuteroalbumin in, 74
dribbling of, occurrence of, 761
examination of, 572
importance of, in diphtheria, 169
fragmentated erythocytes in, 515
importance of quantity of, for prognosis, 516
in cardiac stasis, 126
in congestive hydrops, 557
in fever, 60
in jaundice, 403, 404
in opium intoxication, 727
in vasomotor neurasthenia of the heart, 120
involuntary loss of, in concussion of brain, 712
jet of, changes in form of, 757
mucin and nucleoalbumin in, 581
of diabetric coma, 734
quantity of, as indicator of cardiac force, 566
decreased, in chronic cardiac weakness, 118
reaction of, in continual vomiting, 299
residual, 760
specific gravity of, in chronic cardiac weakness, 118
toxicity in, in eclampsia gravidarum, 732
in fever, 60
in infectious diseases, 617
Urobilin, formed from blood pigment, 611
in blood, in urobilin icterus, 611
in hyperemia of liver, 416
in intestinal putrefaction, 611
in jaundice, 612
in urine, relation of, to stercobilin, 611
ways of formation of, 611
Urobilin-icterus, 611
hepatogenous jaundice and, 402
Urobilinogen and white stools, 451
Urobilinuria and jaundice, 611
enterogenous, 611
febrile, 60

Urobilinuria, following blood effusions, 421
in amyloid kidney, 558
in heart disturbances, 129
in "hepatalgie des asthmatiques," 446
in intestinal putrefaction, 611
in scarlet fever, 427
in typhoid fever, 425
occurrence of, in diseases, 611
pathogenesis of, 611
toxic, 612
Urotoxic coefficient, 643
of Bouchard, 617
Urticaria complicating epidemic jaundice, 422
gastric atony in, 346
hemorrhagica, 521
in serum disease, 626
Uterus carcinoma, metrorrhagia in, 519
Uvula in diphtheria, 317
stimulating cough, 262

Vaccination against small-pox, 640
danger of autoinoculation from, 640
duration of immunity through, 640
not contraindicated in hemophilia, 524
Vaccinia, general, following vaccination, 641
Vagus affections, heart in, 185
auricular, stimulation of, producing cough, 257
compression of, in tachycardia, 186
degeneration of, and bradycardia, 182
effect of paralysis of, 185
effect of stimulation of, 185
galvanization of, in paroxysmal tachycardia, 150
irritation of, and bradycardia, 92
in miliary tuberculosis, 211
in pericarditis, 146
in pulmonary embolism, 211
paralysis of, 91
occurrence of, 663
pressure on, in paroxysmal tachycardia, 150
section of, and act of vomiting, 277
Valleix' points in intercostal neuralgia, 255
Varices in obesity, 22
Varicose veins, cause of intestinal hemorrhage, 505
Vascular obstruction and hemorrhage, 492
spasms in angnia pectoris, 237, 238
system, changes of, in scarlet fever, 171
hypoplasia of, 112
peripheral, in pneumonia, 158
Vasomotor nerves, changes of, in scarlet fever, 171
neurosis in gout, 240
Vegetable diet and number of stools, 470
Veins, 112
cervical, collapse of, during diastole, 102
pulse of, 112
swelling of, in pleurisy, 161
danger of sponging, during operations, 87
dilatation of, 112
in uncompensated heart lesions, 128
pulmonary, in pericarditis, 146
pulsation of, in cardiac weakness, 118
swollen, significance of, 112

Venesection in aortic aneurysm, 154
in autointoxications, 646
in capillary bronchitis of children, 207
in carbon dioxid intoxication, 231
in carbon monoxid poisoning, 723
in cardiac asthma, 219
in cerebral hemorrhage, 694
in granular kidney, 167
in icterus gravis, 411
in morphin poisoning, 728
in pneumonia, 210
in pulmonary edema, 214
in uremia, 731
technic of, 647
Venous circulation in obesity, 21
collapse, diastolic, in concretio pericardii, 113
hum, 107
in chlorosis, 181
pulse, negative, 112
positive examination for, 113
in mitral insufficiency with open foramen ovale, 113
in tricuspidal insufficiency, 113
stasis, in obesity, 22
inciting eclampsia, 711
jaundice in, 416
thrombosis and pulmonary embolism, 211
Ventricle, left, in aortic aneurysm, 152
right, hypertrophy of, in emphysema, 160
Vertigo, absence of, in children, 742
after excessive mental overexertion, 746
and staggering, 740
as aura in epilepsy, 746
at high altitudes, 741
by reflex action, 750
cerebellar, nystagmus in, 742
occurrence of, 742
due to ear lesions, except Ménière's syndrome, 749
e stomacho læso, 645
from eye lesions, 751
from stomach lesions, 750
galvanic, 657, 741
gastric, 741
general pathology of, 742
in abscess of brain, 745
in angina pectoris, 745
in autointoxications, 750
in Basedow's disease, 746
in brain tumor, 743
in carbolic acid poisoning, 725
in cerebral anemia, 745
in cerebral arteriosclerosis, 744
in cerebral atheroma, 152
in cerebrasthenia, 746
in circulatory disorders of brain, 744, 745
in diabetes mellitus, 750
in digitalis intoxication, 133
in encephalomalacia, 744
in epilepsy, 746
in gastric ulcer, 381
in hyperemia of brain, 745
in hypochondria, 747
in hysteria, 746
in infectious diseases, 750
in interstitial nephritis, 167

Vertigo in intoxications, 749
in jaundice, 405
in Ménière's disease, 710
in meningitis, 745
in migraine, 747
in multiple sclerosis, 745
in neuroses, 746
in obesity, 178
in opium poisoning, 727
in quinin poisoning, 750
in sea-sickness, 751
in syphilis of brain, 744
in syphilitic meningoencephalitis, 704
in syringomyelia, 749
in tabes, 749
in traumatic neuroses, 747
in tumor of cerebellum, 743
in uric acid diathesis, 750
in vasomotor neurasthenia of the heart, 120
nasal pharyngeal and laryngeal, 751
of high altitudes, 745
on fracture of base of skull, 754
on lumbar puncture, 703
on meteorism, 465
on paralysis of eye muscles, 743
on rotation, 741
in relation to other forms of vertigo, 741
on terror, 745
persisting on lying down, 743
preceding cerebral hemorrhage, 691
preceding cerebral thrombosis, 696
produced by vomiting, 742
semiotic significance of, 742
special pathology of, 743
treatment of, with galvanic current, 752
Vessels, peripheral, changes of, in diphtheria, 168
Vestibular nerve, irritation of, and vertigo, 742
Vincent's angina, 319
diagnosis of, 320
forms of, 320
Virus in rabies, 628
Virus fixe in hydrophobia, 628
Viscosity of blood, effect of sodium iodate on, 151
Vision, impaired, in scurvy, 522
yellow and green, in digitalis intoxication, 133
Visual disorders due to hemorrhages, 529
Vocal cords, necrosis of, in septic diphtheria, 318
spasm of, 200
dyspnea in, 200
Voice, bleating, in retropharyngeal abscess, 323
in tracheal stenosis of children, 204
hoarse, in aortic aneurysm, 153
in exsiccation of infants, 368
Volvulus, bloody stools in, 391
forms of, 391
in intestinal scarcoma, 383
of cecum, symptomatology of, 392
of children, frequency of, 392
symptomatology of, 391
Vomited matter, ammonium carbonate in, 731
bile in, 344, 347
blood in 285, 344, 347
examination of, 278, 344
Vomited matter, fecal odor of, 288
in lye intoxications, 718
mucus in, 344
parasites in, 347
pus in, 344
Vomiting, advantage and disadvantage of, 277
after quinin, 64
and coughing, 295
bilious, in intestinal obstruction, 399
in mesenteric incarceration, 390, 391
center for, 296
in medulla oblongata, 277
central, 296, 278
cerebral, character of, 298
in intestinal autointoxication, 645
"coffee ground," 286
due to overfeeding, 290
due to vagus compression in aortic aneurysm, 153
ectogenous, 299
effect of, on bowels, 369
factors inciting and inhibiting, 301
fecal, in intestinal carcinoma, 395
significance of, for topical diagnosis of ileus, 399
following anesthesia, 298
following concussion of brain, 712
following lumbar puncture, 703
following use of antipyrin, 65
following use of salicylates, 65
following violent cough, 294
general remarks on, 277
habitual, causes of, 301
in children, 301
hysterical, subcutaneous feeding in, 342
importance of anamnesis in, 279
in acute gastritis, 280
in ammonemia, 598
in angina lacunaris, 315
in atresia ani or recti, 389
in Basedow's disease, 298
in brain pressure, 297, 298
in brain tumor, 296
in carbon monoxid poisoning, 723, 724
in carcino ma, 286
in cardiac paralysis of diphtheria, 189
in chronic alcoholic gastritis, 281
in chronic gastritis, 281
in concussion of the brain, 184, 297
in congenital pylorus stenosis, 292
in digestive disorders in infancy, 290
in digitalis intoxication, 133
in dilatation of the stomach, 281
in diseases of urinary organs, 294
in ear affections, 296
in esophagus affections, 278
in infantile atrophy, 293
in gastric hypersecretion, 287
in gastroenteroanastomosis, 294
in gynecological affections, 295
in hemicrania, 298
in internal incarceration, 390
in intestinal diseases, 288
in intestinal invagination, 393
in intestinal perforation, 294
in intestinal thrombosis, 398

Vomiting in intoxications, 280, 714
in iodoform intoxication, 725
in liver affections, 294
in melena neonatorum, 293
in Ménière's disease, 298, 710
in meningitis, 297
in migraine, 673
in motor insufficiency of stomach, 316
in nephrolithiasis, 451
in pancreas necrosis, 24
in peritoneal affections, 288
in peritonitis and ileus, 288
in pertussis, 295
in phosphorus intoxication, 720
in phthisis, 295
in pregnancy, 295
in purpura abdominalis, 521
in pyloric stenosis, 281
in scarlet fever, 301, 302
in sea-sickness, 298, 751
in sinus phlebitis, 677
in snake poisoning, 730
in stomach affections, 279
in sunstroke, 298
in syphilitic meningoencephalitis, 704
in thyroidism, 32
in ulcer of the stomach, 284
in uremia, 290, 731
in vagus paralysis, 663
in volvulus, 391
incessant, in congenital pyloric stenosis, 45
in paralysis of heart, 243
initial, in ileus, 398
laryngeal and pharyngeal, 294
leading to acidosis, 594
nervous, 299
in pharyngitis, 281
of bile, in duodenojejunal stenosis, 388
of fecal matter, see Ileus
on injury of intrathoracic nerves, 250
periodical, 594
causes of, 301
of children with acetonuria, 301
preagonal, in diphtheria, 301
produced by vertigo, 742
producing vertigo, 742
recurrent with acetonuria, 594
reflex, 278
reflex arc of, 277
Vomiting, "rice-water," in Asiatic cholera, 347
spinal, in poliomyelitis, 298
stercoral, in ileus, 388
in volvulus, 391
through intestinal parasites, 289
toxic, 299
uncontrollable, in scarlet fever, 635
watery, in tabes and alcoholics, 347
Vomitus, coffee ground, in gastric carcinoma, 504
matutinus, 347

Walking, delayed, 51
Water, cold and hot, as styptic, 494
Waxy degeneration of musculature, 253
Weight, daily increase of, in infants, 51
in different years of life, 49
in the first days of life, 50
increase of, in undernourished infants, 40
loss of, in fever, 59
Weil's disease, 423
and cholangitis, 424
Weir Mitchell treatment and Burkhart's modifications, 14
Whooping cough, 208, see also Pertussis
cerebral anemia in, 700
cerebral apoplexy in, 691
constipation in, 369
in swelling of bronchial glands, 204
spasmodic sneezing in, 651
Winckel's disease, 421
hemorrhages in, 492
symptoms of, 528
Wine, as excitant, 131
Wry-neck following hematoma of the new-born, 526

X-rays, action of, on spleen and bone-marrow, 541
and clubbed fingers, 5
in aortic aneurysm, 153
in intrathoracic lymphoma, 204
in the treatment of anemias, 544
value of, in chest affections, 233
in diagnosis of esophageal diverticula, 327
Xanthopsia in jaundice, 405

Yeast, as cathartic, 379
cells in stomach content, 352
Yellow fever, jaundice in, 428

RC
69
P513

AUG 12 1974

RAYMOND H. FOGLER LIBRARY
DATE DUE

DEC 14 1982

JUN 08 1984

JUN 04 1988

RC69.P513 ORO
Clinical symptomatology
3 7550 00050710 4